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Battelle Technical Review

IN THIS ISSUE: Scientific Man and Unscientific Society

VIGNETTE

RONALD F. DICKERSON

Without question, broad industrial acceptance of atomic energy depends upon the successful solution of a number of problems. Most important of these, R. F. Dickerson believes, are the problems associated with materials. "Scientists", he points out, "are ransacking the earth's store of available materials and developing previously unknown forms and combinations of them to find metals and ceramics that will hold up under the nuclear reactor's demanding environment. Finding satisfactory materials is only the first step; then technologists must find economically feasible methods for producing and fabricating them. In the end, reactors will become economically competitive when they can be built of materials that will stand up for long periods at the high temperatures necessary for efficient operation."

Research on reactor materials has been the great interest and primary concern of Steve (so he is called by his colleagues) since he became a member of the Battelle staff in 1948. Over the years, he has contributed to a number of important research accomplishments. He participated in the development of melting and casting techniques for zirconium-uranium and uranium-base alloys; he was associated with the successful solid-state bonding of uranium and aluminum; and he helped develop improved microscope hot-stage equipment. In addition, Steve has been associated with research on radiation damage of reactor fuels and structural materials and on the physical metallurgy of many reactor fuels.

As chief of Battelle's reactor metallurgy division, Steve, with his colleagues, has conducted research in support of almost all the major reactors, including the Production, Naval, Merchant Ship, Fermi Fast Breeder, Pressurized Water, and Army Gas-Cooled reactors. Among significant studies now under way in his group are the development of uranium monocarbide for fuel, high strength niobium alloys, thorium alloys for specific applications, and iron-chromium-aluminum alloys for reactor use.

With more than a dozen publications bearing his name as author, recognition of Steve's work is reflected in his membership on the Steering Group for the Reactor Materials Committee of the Atomic Industrial Forum and on the Steering Committe of the Reactor Materials Metallographic Group. His professional activities include membership in the American Society for Metals, the American Foundrymen's Society, and the Electrochemical Society.

His association with the Battelle staff began immediately after Steve received his M.S. in metallurgy at Virginia Polytechnic Institute. Earlier, he had received a B.S. in metallurgical engineering, with honors, from the same institution.

A busy family life keeps Steve and Margaret Jane, his wife, on their toes. Both follow with some wonder the progress of their sons Steve, Jr. (12) and Duke (3). Both Steves are interested in baseball, Steve, Jr. as a player and Steve, Sr. as a coach of youthful players. The latter is also active in the Boy Scouts and, along with Margaret Jane, in church work. Golf, music, and bridge are for lighter moments.

BATTELLE TECHNICAL REVIEW

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The Future of Technology

Past experience has indicated a correlation between the volume of research effort and the pace of technological progress. More research has meant more innovations and developments—an acceleration of technological advance. Presumably, this correlation will hold up until some point of diminishing return has been reached which, as yet, is not in sight.

But, the sheer volume of research effort may not be the controlling factor in the future of technology. There is some reason to believe that depth of research may be more important to future progress than the number of dollars expended, the number of men employed, or the number of projects undertaken. If it is true, as many commentators have noted, that both industry and government are moving toward greater depth in scientific investigations, this factor, more than the size of the over-all research activity, may be the determinant in technological progress in the sixties.

By depth in research is meant how far the work progresses toward the seeking of basic causes, underlying principles, scientific reasons. In the past, much of our technological progress has been made through laboratory empiricism—the trial and error approach—rather than through understanding of basic principles. Most often we have been concerned with how to accomplish something—how to harden an alloy—how to catalyze a reaction—how to increase the performance of a product. The question of why something works has not been too much of a concern as long as it does work. Tremendous technological progress has been made just by finding how to accomplish a desirable end.

Certainly, there is more "why" research going on now than ever before—even on a percentage basis. Some metallurgists hold that to attain the superior strength and heat-resistant properties in metals that engineers demand will require a metallurgy based on clearer understanding of theory. The retiring president of the American Society for Metals noted in a recent magazine editorial that future advances in welding technology will arise through more probing inquiry into welding phenomena. In chemistry, there is increasing accent on causes and principles and much work to enunciate new theory. In medicine and the life sciences, there is concerted effort to find out more about the "why" while seeking empirical means to answer "how".

The net result of this concern could be an explosion of technological development even beyond that expected from the over-all volume of research effort. For, as has been demonstrated many times in the past, rapid sequences of practical and industrially useful results often follow new breakthroughs in understanding. All things being equal, greater attention to depth in industrial and governmental research should prepare the field for unforeseen and unexpected technological benefits.

If this proves to be true, the sixties may produce scientific and technological values beyond even the most optimistic predictions.

David C. Minton, vice president,
Battelle Memorial Institute

Scientific Man and Unscientific Society*

Though the accomplishments of scientists benefit everyone, their effectiveness may at any time be limited by the power of society. Mutual understanding enables scientists to work most effectively and society to reap the greatest benefits from their activities.

by FRANK C. CROXTON

IT WAS NEARLY 30 YEARS AGO that Reinhold Niebuhr expounded the thesis that the moral behavior of individuals is tremendously different from that of the national, racial, and economic groups which constitute society. He presented the thesis in a book titled "Moral Man and Immoral Society", and it is an adaptation of that idea which forms the basis of the present discussion.

Niebuhr's considerations, from many angles, point up a startling similarity when scientific concepts and applications of individuals on the one hand, and of society on the other, are contrasted. Such an extension can be of great importance in these days of emphasis on science. Accordingly in what follows, it will be shown that Niebuhr's ideas can be applied to science as they were to morals. In addition, it will be indicated that this has been true for science during many generations. Similarly, the hope will be held out that the disparity of scientific attitudes by individuals and society need not be inevitable, but a rapprochement could be of inestimable benefit to all. Throughout there will be intermingled references to scientific man, whether he be scientist or layman, as well as to the scientist in his profession, both of them in relation to society from group to nation.

In 1932, the writings of Reinhold Niebuhr, now an outstanding theologian, reflected some of the Marxian inspired philosophy which often touched those interested in the problems of the workers. During the intervening years, though Niebuhr has lost none of his concern for the common man, he has put considerably less emphasis upon economic salvation, and he is concerned primarily with concepts that have grown out of his significant studies of religious problems.

Niebuhr has said that in every human group there is less reason to guide and to check impulse, less capacity for self-transcendence, less ability to comprehend the needs of others and therefore more unrestrained egoism than the individuals, who compose the group, reveal in their personal relationships. As a part of the voting public, comparatively few citizens can view a problem of social policy without regard to their interest, but, as individuals, they have a moral code which makes the actions of collective man an outrage to their conscience. Niebuhr says further that as individuals, men believe that they ought to love and serve each other and establish justice between each other. As racial, economic, and national groups they take for themselves whatever their power can command. He says in several different ways that the majority does not identify right but, rather, shows where the power resides. Niebuhr speaks often of the coercion extant in society. He goes further to point out that the principle of majority rule does not lead to justice but really merely to a precision of power. Thus, majority rule means that might makes right but without excluding the possibility that the source of power may conceivably also be the source of truth.

Scientific truth is never determined by the majority except by accident, but the action of the majority may well nullify the effectiveness of science as, for example,

*Presented by the author as retiring vice president, American Association for the Advancement of Science (chairman, Section P, Industrial Science) at the Annual Meeting of the Association in Chicago, December 29, 1959.

in the nationwide contention over the fluoridation of municipal water supplies. Cervantes' words through the person of Don Quixote come to mind: "Remain always at odds with the majority", he said, "for men who, singly, may be right, together are always wrong".

Just as Niebuhr has called attention to morality differences as between man and society, it has become abundantly clear in recent years that the individual may be scientific while society is not. Even the untrained individual shows the potentialities, the will, and the absence of crippling inhibitions, which surround society with rigidifying taboos. The individual apparently feels free to let his attitudes progress. Society is excessively conservative, antiscientific and so, in many ways, immoral.

The Scientist and Society

Since science is touching everyone more strongly than ever before, it becomes important to assure the position of aspiring man in a conservative or even antiscientific society. The concept of each radically new discovery has almost always been the product of one person's mental processes. Its further development is likely to be the work of many. Its ultimate fruition and universal adoption can be hindered or prevented by unscientific society.

What is being said here does not picture the individual as scientific and the team of scientists as unproductive. It does say, however, that the team is the product of the individual minds with due attention to the synergistic relationship among its members. An illustration is furnished by the discovery of Sir Alexander Fleming, when his efforts to grow staphylococcus colonies were thwarted by foreign materials, presumably from the air. Pasteur, as well as Tyndall, had encountered the same discouraging setback. The difference between them was that Fleming had the time, the inclination, and the curiosity to do something about it. He carried on to the point where a team encompassing several scientific disciplines became necessary. Thus, the so-called Oxford Team contributed enormously, in time producing a concentrate which, they felt, must be the bacteriostatic factor of penicillium mold. Later it was found to contain 1 per cent pencillin. The eventual commercial production of penicillin and its worldwide availability are now well known. The point to be noted here is the importance of freedom to the scientific thinking of Professor Fleming, coupled with his perspicacious understanding of the benefits which could accrue to mankind. Not to be ignored, however, as we think of penicillin and others of the powerful chemotherapeutic agents, is the response of society itself. Generally the acceptance has been good. From one point of view it is too good, and this is what would be meant by saying that all too often unscientific society associates the discovery with the evil that may result from its use.

Although Newton is never blamed for the ill effects of a catastrophic fall, society does look askance at the partially anonymous company of scientists who conceived of and finally achieved explosive nuclear fission. Scarcely anyone, however, sees harm resulting ever so indirectly from the discovery of penicillin except, possibly, as an awareness spreads that resistant strains of pathogenic organisms may appear and multiply. But penicillin is a life saver. Its area of greatest potential achievement in this respect is among the world's peoples who have, at once, the highest death rate, the highest birth rate, and the least awareness of science. Niebuhr said that the moral obtuseness of human collectives makes a morality of pure disinterestedness impossible. In this modern day, no one can properly assume a disinterested attitude toward science. Society will praise or condemn a potent antibiotic, explosive or controlled nuclear energy, or an herbicide suspected of being carcinogenic. The individual, whether scientist or layman, is free to judge the merits of each, to appraise its value to himself and his fellow man, and to judge the applications for good, condemning those for evil.

At the 1959 meeting of the American Cancer Society it was stated that of the 77,000 compounds screened for anticancer activity in animals, 87 are now being investigated clinically (50 hormone drugs and 37 chemical agents). Within a few days, a highly overoptimistic reaction was shown by the lay public, evidently through reading *headlines*. The influence of

Dr. Croxton has been associated with much chemical and chemical engineering research during his more than 20 years at Battelle. As technical director he has been interested also in radiation chemistry and nonclinical medical research. During their formative years he was active in the establishment of the Battelle laboratories in Frankfurt, Germany and Geneva, Switzerland. Recently a vice president of the American Association for the Advancement of Science, Dr. Croxton is active also in other professional societies in the United States and Europe. The author has had, for many years, a strong interest in the relationship of research and technology to the welfare of society.

headlines on unscientific society appears to be strong. The necessity of reading and comprehending beyond the headlines is obvious.

A Scientific Elite or Cooperation in Society?

In spite of society's innate inability to be truly scientific, the creative individual must be viewed as one of its greatest assets. Michael Polanyi, in his Lindsay Memorial Lectures on The Study of Man, puts mental productivity in its proper place by saying that even if we admitted that an exact knowledge of the universe is our supreme mental possession, it would still follow that man's most distinguished act of thought consists in producing such knowledge; the human mind is at its greatest when it brings hitherto uncharted domains under its control. Profoundly unique objects are rare, he continues, wherever these are found (whether in nature or among the members of human society) they are interesting in themselves. Where will these unique attributes be found next and what will their nature be?

> *"Human thought grows only within language and since language can exist only in a society, all thought is rooted in society."*
>
> **Michael Polanyi,**
> *The Study of Man*

The divine spark of creativity in individual man is given substance by Michelangelo's unfinished figure of St. Matthew in the Accademia di Belle Arti, in Florence. To the sculptor, St. Matthew was already in the block of marble. It was for him to remove the concealing outer sheath, revealing the form which was the creature of his creative mind. How similarly it can be said that the scientific achievements of Gibbs, Einstein, Hilbert and others are revelations arrived at by tearing away the obfuscations of previous misconceptions and erroneous assumptions. The mind of man and his ability to communicate what it has evolved are precious things, developed during only a relatively few centuries, after some millions of centuries of evolution. They, in themselves, represent a supreme trust placed in us.

Just so, scientific man, in his continual ideological battle with unscientific society bears a trust which cannot be taken lightly. It is for him to create an atmosphere conducive to orderly thinking and a scientific approach by society. One can picture a scientific "Liberty, Equality, and Fraternity". There must be the liberty to pursue creative independent research and to have radical ideas such as heliocentricity and relativity, as well as some ideas that scarcely see the light of day, but set others to thinking in a kind of intellectual fission process.

The concept of an elite has never been palatable to Americans. We might, however, think of an elite, a scientific elite of responsibilities, if not of perquisites. Beyond this, there must be an equality which certainly means that everyone of us possesses equal dignity in the judgment of his fellow man. It as certainly does not mean that each of us is to be rewarded to the same extent for his contributions to the welfare of society. Nor does it mean that each of us in his youth is to be taught in the same way. Rather, one will advance more surely by one method of teaching, while others are best instructed by entirely different methods. In the end, all of us will arrive at a realization of the maximum to be gained from life, which includes being of maximum value to society.

Furthest from this concept is the idea of equality as uniformity whose stultifying effect is so apparent in a small but all too visible portion of the world's physical and mental teenagers. Give us many minor Henry Clays who would rather be right (scholastically) than president (of their high school fraternity). Give us many who are anxious to excel whether in pure intellectuality, music, art, or athletics. Let us deplore the all too-frequent tendency toward the gregariousness of mediocrity wherein the person, like the tree in a grove, withstands the storm but, left alone, falls before the wind.

For years to come we will be creatures of the surface of the earth. Fraternity is essential to peaceful existence and to maximum productivity for the good of man. This is not the forced cooperation of a military effort, but the voluntary joint action toward maximum individual creativity. In science, team work is relatively new. It has accomplished amazing things but it must act so as to bring out the best in each member. For autogenerated ideas there must be sympathetic and objective criticism. Flaws and virtues must be detected.

In a substantially broader sense, the concept of fraternity is essential as it brings scientific man and an unscientific society to a higher degree of rapport. Society must have confidence in scientific man, even more so as the years pass and science becomes a greater and greater influence in our lives and even our survival. Society must tune itself to a higher level of scientific research entirely aside from such development effort as may follow it. The higher level of research most certainly must be in terms of quality as well as quantity. Society's confusion of the two meas-

ures is voiced by the frequently heard question "How much does research cost?" Never does one ask "What is the cost of *not* doing research?", but the expense of doing research is usually expressed in terms of cost per man, often regardless of the type of man or the facilities provided him.

More appropriately, of course, we should think of research *output* by an individual or a group not in terms of cost, but rather as return on an investment. Even so, we are faced with embarrassing questions such as "What had been the investment in Albert Einstein up to and including 1905, the year when he presented the special theory of relativity?", and "What value is to be placed on his output as of then—what value as of now?" As each man has the freedom and the potentiality to be scientific, it is his duty to influence society to the utmost to throw off its shackling restrictions which make it at once unscientific and, according to Niebuhr, immoral.

"Knowledge is power, but it is power for evil just as much as for good. It follows that, unless men increase in wisdom as much as in knowledge, increase of knowledge will be increase of sorrow."

Bertrand Russell,
Impact of Science on Society

To a degree, C. P. Snow, in his Rede Lecture of 1959, is alluding to this same problem. He is disturbed by the cessation of communications between scientists and the literary fraternity. He pictures Chelsea and Greenwich Village as being closer to each other than to South Kensington or M.I.T. He harks back nearly 30 years to the Cambridge of Rutherford's time and to the young research workers there whose superiority was boosted by their remoteness from practical applications—from the necessity of bringing the benefits of science to play on the problems of society. Rutherford, himself, had stated clearly his doubts that the energy of the nucleus would ever be released. This was just nine years before the University of Chicago pile.

Among the dissenters from the totality of such views is Polanyi. He suggests that we are looking too shallowly and that both Freud and Marx, whose teachings affect so much of modern culture, derive their authority by speaking for science. "Unchristian" was the brand of the church in the 1600's. "Unscientific" is its current counterpart. Polanyi considers science the only remaining uncontested intellectual authority, but still incapable of sanctioning the claims of nationalism, religion, or natural ethics.

To a degree, also, it is being said here that man *can* be scientific; society *may* not be or even *will* not be. The unscientific nature of society appears to be an evocation of a multitude of component attitudes each of which is of nearly equal weight. Added to this are the effects of pressures totally unrelated to science. The result is a world, a nation, or a group guided by whim, impulse, or fancied reason with science as a useful contributor to the general welfare, but, at the same time, considered to be a bothersome or potentially dangerous influence.

The World of the Scientist

Strangely, society is both innovating and conservative. It will accept with some alacrity a proprietary product allegedly based on a heretofore undiscovered principle of physics. It will resist in many quarters a mass treatment resulting from hundreds of man-years of capable research promising to alleviate with fair certainty one of the nation's minor ills. Society rarely arrives at a truth through clarification. Rather, disputes are generally resolved through negotiation between contending forces, then yielding by both sides, and eventual agreement to what is palatable, in various degrees, to the contenders. Scientific disagreement is not amenable to this treatment. Instead, discussions and even written polemics lead to clarifications and, barring insurmountable obstacles, eventually to a concept which is considered by all to be correct, not merely not unpalatable. Many will recall the unruffled disagreement between A. H. Compton and the late Robert A. Millikan about the nature of cosmic radiation. Both were eager to find the truth. Each was free to drive toward the truth without regard for nationalistic or sociological considerations. A large body of additional data and the joint efforts of a number of individual scientists have now both complicated the picture and brought about substantial agreement among those conversant with the subject.

Man is stimulated by tantalizing problems which appear to be of no consequence to society. The astronomer, Herschel, it will be recalled, continually sought larger and larger telescopes to resolve nebulae into stars. We have now come to the 200-inch telescope on Mt. Palomar and can photograph star systems at 2×10^9 light years distance. How close this takes us to the time of formation of the galaxies as calculated from the theories based on the cosmology of the Abbe Lemaitre. Similarly close it is, even to the primeval atom or radiation of Gamov. This is indeed a tantalizing situation, especially since two developments appear to offer some promise of extending telescopic range 5

to 10 times, as appears to be needed. First, there is the radiotelescope and second are the space vehicles. It seems likely that the former will be the more powerful, but even so, space travel may facilitate the explanation of radio-wave emissions from Jupiter and thus add to the power of radio waves in the clarification of cosmological problems.

There is probably no more dramatic example of scientific man succeeding in the midst of unscientific society than the accomplishment of the Dutch student Van de Hulst while surrounded by the frustrating influence of military occupation forces. It was Van de Hulst who predicted the 21-centimeter emission of the neutral hydrogen atom once in eleven million years. He predicted further that detectability should be no great problem in view of the vast number of hydrogen atoms in the interstellar clouds. Not until 1951 could his predictions be confirmed experimentally. Since then, the 21-centimeter radiation has been used successfully at Leyden for studies of the Milky Way otherwise impossible with optical telescopes. Finally, it might be noted that any thought of continuous creation requires the production of several hydrogen atoms per cubic mile of space each year. In total, this amounts to the creation of several billion trillion tons of hydrogen each second in the observable universe.

"Who in a democracy, really make the decisions, and how can the decisions, in a modern scientific world, be made wisely and decently unless the public does have some real understanding of science?"

Warren Weaver
in *Science*

The foregoing digest of a problem calculated to intrigue scientific man for some time to come, leads to quite disparate thoughts somewhat significant to society, scientific or not. First, Gamov's concept of a primeval atom of radiation is not inconsistent with the command "Let their be light!". Second, the whole idea of a cosmological beginning may well be an anthropocentric artificiality inconsistent with an expanding or an oscillating universe.

Understanding Between Scientists and Society

If the forces bearing on the group or the nation seem to lead inevitably to an unscientific society, one may well ask whether the situation deserves remedying at all. Perhaps we are resigned to the fact that society will remain unscientific, and should. This would be a dismal prospect, one that would be sure to materialize too often as the periodic "deterioration into egalitarianism and hostility of all that is excellent", as Admiral Rickover has put it.

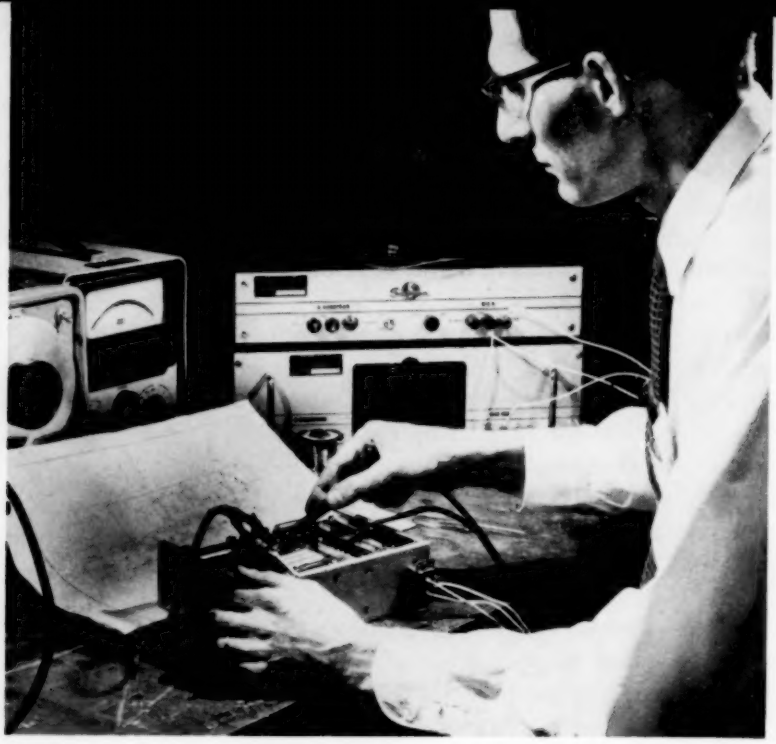
Quite the contrary, as we are struggling to produce the essentials of morality in society, so should everyone of us as a component of the group, strive to make society scientific in its thinking, its behavior, and its reactions. Individuals, groups, and nations may well bring themselves up to date in these times of increasing scientific saturation. Foregoing some frivolities in favor of more and more research suggests a sort of austerity, but not for long. Benefits derivable from scientific investigation are well known. Most important is to allow research the freedom it needs and to act on its results.

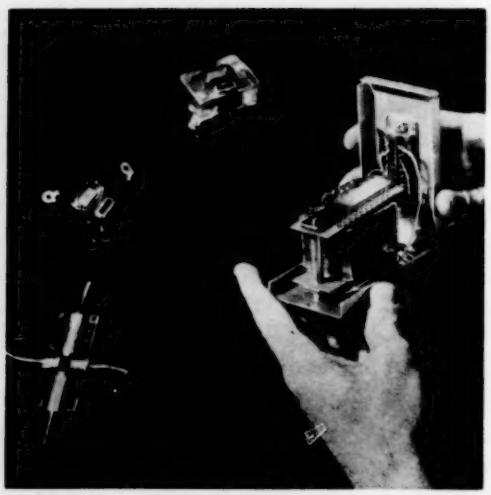
Just as an individualistic ethic may often be embarrassed by society's political policies, so too, may the individual scientist be embarrassed by the hue and cry over basic versus applied research. At this late date we never question the motivation behind Archimedes' elucidation of his principle dealing with the buoyancy of submerged solids. The works of Newton and of the brightest lights of mathematics are undoubtedly of the purest sort. Count Rumford, on the other hand, was engaged in highly practical pursuits when he produced a clarified picture of the nature of heat.

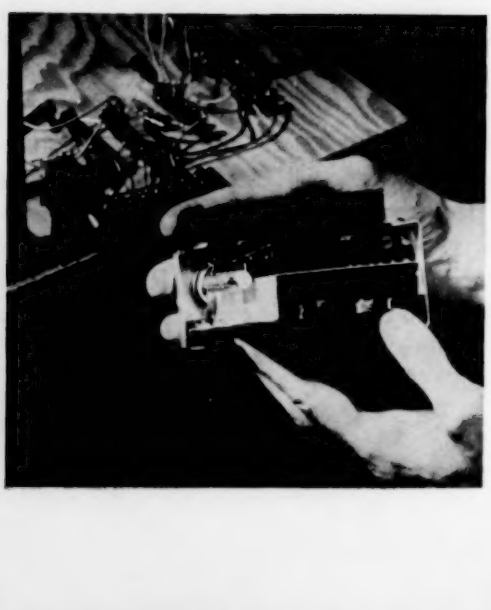
What is significant in these examples, however, is that these individuals had the freedom or took the freedom to develop ideas without being subjected to the stultifying effects imposed by organized society.

What can be done, then, to hasten the day of understanding between scientific man and unscientific society? Education, of course, is an obvious area of concern. Far from suggesting that emphasis on the humanities be reduced while science is given more attention, it is considered to be entirely possible that the humanities may contribute most to alleviation of the forces producing an unscientific society. Science must certainly take an increasingly important position in the educational process, but not to the detriment of other essential fields. Communication must be of the highest order to assure that society has the basis for an integration of its interests and influences into scientific thought and action. Emotion is so much a part of human behavior that one can scarcely imagine it assuming a declining role in society's behavioral pattern. Being scientific, however, need not exclude humanitarianism or its importance in world affairs. Finally, with reference to what we can do is the clear mandate that every one of us make the most of his privilege, ability, and duty to be scientific. In doing so we can impart the scientific spirit to society to make a far better world for ourselves and for posterity.

CREATING A HALL-EFFECT MULTIPLIER UNIT







The search for simpler, more reliable, more accurate computer equipment is constant. In a somewhat novel approach to the development of an analog multiplier, Battelle technologists are utilizing the Hall effect in research for the Aeronautical Accessories Laboratory of Wright Air Development Division.

The Hall effect is the redistribution of charge carriers in a conductor in the presence of a magnetic field and manifests itself as a voltage across the conductor. The Hall voltage is proportional to the product of the current and the magnetic flux density, and, when instrumented, it can be utilized in an analog computer.

Steps in the development of the components of the multiplier are indicated in the photos. The Hall assembly began with a simple component mounted on a cover glass (left in the top photo at left). Clockwise are shown two rough assemblies incorporating the required magnets and the completed form shown in the hand. The first crude model of the power amplifier, which drives the magnetic core of the multiplier, appears behind the completed model in the technologist's hand (bottom, left). At the top, Donald H. Ebert is shown checking one of the output amplifiers he developed. All three units will be plugged into a larger assembly.

According to Alexander Finlay, chief of Battelle's electrical engineering division, an accuracy of one-half of one per cent, which was achieved in experiments, is being sought for the multiplier.

Stainless Steels for Aircraft and Missiles

Several families of high-strength stainless steels have attracted the interest of aircraft and missiles makers. The author discusses the problems their use involves and suggests how these may be overcome.

by A. M. HALL

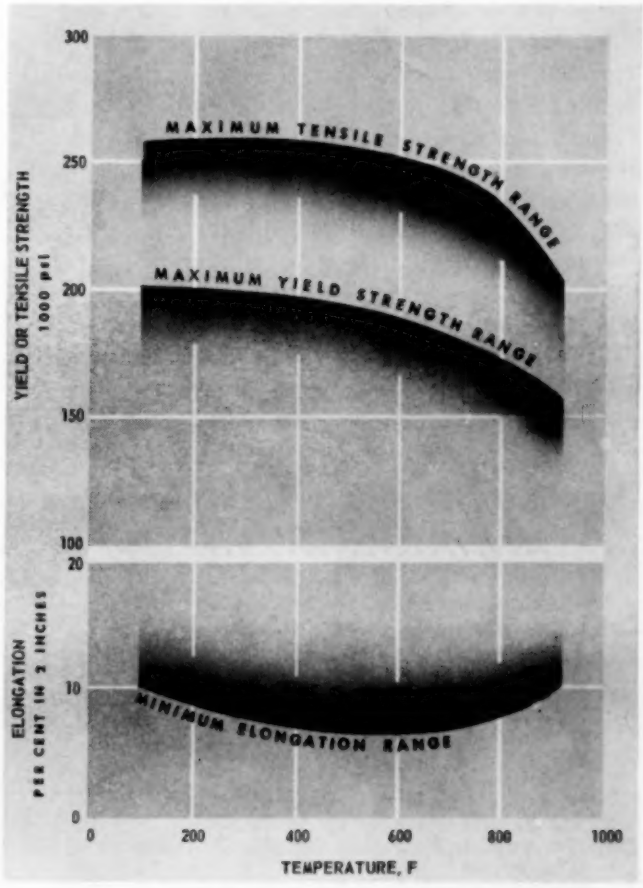
DURING THE PAST 15 YEARS several families of steel have been evolving which are capable of being used at the comparatively high levels of 180,000 to 300,000 psi tensile strength. Among these families are the martensitic stainless steels, the semiaustenitic precipitation-hardenable, and the cold-rolled austenitic stainless steels.

In large part, these steels have been developed in response to goading by the aircraft and missile industry. The demand for materials of ever higher strength is insistent, and these materials are being used increasingly because of their excellent properties.

Applications for ultrahigh-strength materials are critical by nature; specifications are necessarily stringent; and the utmost in performance is demanded of the materials. To use these materials successfully requires exceptional care and control in every step of manufacture and fabrication.

This turn of events arises from the unfortunate fact that, as metals and alloys are compounded and processed to possess the ultimate in strength, difficulties are encountered. The alloys lose ductility and toughness; their mechanical properties become increasingly sensitive to small changes in composition and process variables; and they may be more readily deteriorated by their environment, both in manufacturing and in service. This means, for example, that: composition must be closely controlled during melting; unconventional melting methods (i.e., in vacuum) may be required; heat-treating temperatures and times must be held within narrow limits; and heat-treating atmospheres must be as neutral as possible toward the metal, or the work must be otherwise well protected. In fact, extraordinary care must be taken in almost all production operations, and special procedures may have to be devised for fabricating and processing the material as well.

On the other hand, as experience with the use of these families of steel at very high strength levels has accumulated, improved methods of making and handling them have been developed and improved steels have resulted. Moreover, the advantages and disadvantages of each class of steel are better understood, leading to better choices and, hence, the use of the



1. *Elevated-temperature tensile properties of martensitic stainless steels.*

materials where they will be most effective. Though many problems remain, many have been solved.

Martensitic Stainless Steels*

Properties and Uses. The current high-strength martensitic stainless steels have their basis in the AISI 400 series, as exemplified by AISI Types 410, 416, 420, and 431. They generally contain 11.5 to 14.0 per cent chromium and up to 0.30 per cent carbon, depending on the grade. AISI 431, however, carries 15.0 to 17.0 per cent chromium and 1.25 to 2.50 per cent nickel. These grades of steel have a long history of use in small forged and machined components for applications calling for high strength and moderate corrosion resistance. AISI 420, for example, is a conventional stainless knife steel.

Over the years, many modifications of the 410 and 420 type alloys have been developed and are available under a variety of trade names and numbers. Included in the family are 418, 419, 422, 422M, 12MoV, 1420WM, Greek Ascoloy and Lapelloy. The modified steels may contain combinations of nickel, molybdenum, vanadium, tungsten, copper, and boron in different proportions, in addition to chromium and carbon. Increased strength, retention of strength at elevated temperatures, and, more recently, increased resistance to tearing have been sought in the modifications. These steels have been used in blades for compressors and steam turbines, compressor and turbine wheels, high-temperature bolting, and other applications requiring strength at moderate temperatures.

The aircraft and missile industry utilizes these steels for such items as brackets, clamps, small castings, and high-shear rivets and bolts. Several types are produced in sheet form and are being considered for pressure vessels. In fact, most of the martensitic stainless steels are available in such usual forms as sheet, strip, plate, bar, forgings, and castings.

*High-chromium steels which can be hardened by quenching and tempering.

TABLE 1. *TYPICAL RUPTURE STRENGTHS OF MARTENSITIC STAINLESS STEELS*

Temperature, F	Stress (1000 psi) to Rupture in the Indicated Time		
	10 Hours	100 Hours	1000 Hours
800	..	210	180
900	..	130	90
1000	80	70	60
1100	30	22	15

The annealing of martensitic stainless steels usually involves heating at 1500 to 1600 F and slow cooling to about 1000 F before air cooling. They are hardened by heating at 1750 to 1925 F, air cooling or oil quenching, and then tempering. A wide range of mechanical properties is obtainable by varying the treatment.

Practices and Problems. The principal reason for using high-strength materials is to hold down or reduce the weight of a structure. If the effort is to be effective, however, the entire cross sections of the components should be at full strength. In the case of hardenable steels, strength is lost and fatigue resistance reduced when their surfaces are decarburized. The steels are frequently decarburized to a greater or lesser extent during mill processing operations. When the stock is machined this is unimportant. When the material is used with the as-received surface intact, however—especially thin sheet and strip to be heat treated to high-strength levels—decarburization at the mill can be serious. To offset this problem, some missile manufacturers have set stiff specifications on maximum allowable depth of decarburization of sheet. Others grind or chemically mill off the decarburized layer.

Decarburization and scaling, as well as carburization, may be encountered during hardening, annealing, and normalizing heat treatments. Controlled furnace atmospheres, molten neutral salt baths, and protective coatings (usually proprietary compounds) are used to prevent or minimize these problems.

Two commonly-used protective furnace atmospheres are "endothermic" and "exothermic". A typical endothermic atmosphere, produced by burning a 2.25:1 air-fuel gas mixture in the presence of a catalyst, is given below. An exothermic atmosphere, resulting from burning a 9.5:1 air-fuel gas mixture followed by

The author has conducted and supervised research on most types of high-alloy steels. Hall's particular interest have been directed to steels for high-temperature applications; high-alloy casting steels; high-temperature, electrical, age-hardenable, and stainless steels; and to metal fabrication methods. Some 35 papers bearing his name deal with nickel and its alloys, copper recrystallization, graphite formation in steel, and kindred subjects, and he is author of The Engineering Foundation's monograph on nickel in iron and steel.

removal of the CO_2 formed, is also shown. External heat must be applied in burning a endothermic mixture; none is needed for an exothermic atmosphere.

Atmosphere	%CO	%H_2	%CH_4	%N_2	Dew Point, F
Endothermic	19.0	38.0	1.5	41.5	—10
Exothermic	2.0	2.0	..	96.0	—40

The capability of such atmospheres to carburize or decarburize is strongly influenced by the presence of small amounts of water vapor. Therefore, control of the dew point of the furnace atmosphere affords a convenient means of regulating the degree of neutrality of the atmosphere toward the work.

Neutral salt baths are usually molten mixtures of chlorides or chlorides and carbonates to which a "rectifier" such as methane, graphite, or ferrosilicon is added to keep the bath neutral toward the work.

TABLE 2. *TYPICAL CREEP STRENGTHS OF MARTENSITIC STAINLESS STEELS*

Temperature, F	Stress (1000 psi) to Produce the Indicated Permanent Strain in 1000 Hours		
	0.1 Per Cent	0.2 Per Cent	0.3 Per Cent
700	115	130	140
800	80	100	115
900	10	20	30

The fabricator may be plagued with nonuniformity of response to heat treatment from lot to lot of steels such as AISI 410, 416, and 431. This is generally attributed to looseness in the chemical-composition specifications. To overcome the situation, fabricators are tending to order the steels to narrower than standard composition ranges, particularly for carbon and chromium content.

The martensitic stainless steels, as annealed, generally undergo deep drawing satisfactorily. However, they tend to be crack sensitive on welding, and some possess poor resistance to crack propagation. These problems are being vigorously attacked and substantial progress is being made.

These steels are commonly welded by the inert-gas tungsten-arc process. Covered electrodes have been developed for fabricating thick sections from a number of these steels. Filler wire is generally of the same composition as the base metal. Resistance and flash welding also may be used but, in resistance welding, the nugget must be tempered in place immediately to prevent cracking on cooling. Preheating is frequently not necessary. However, postheating is essential to avoid cracking and should be done soon after welding. Postheating frequently consists in annealing at about 1500 F and slow cooling to 1000 or 1100 F, or tempering at 1000 to 1200 F. For some of the steels, it is often possible to obtain the desired mechanical properties in the joint merely by tempering after welding, instead of using the complete hardening and tempering procedure.

In tempering these steels, it is general practice to avoid the temperature range of 700 to 1100 F. An embrittling phenomenon occurs in these steels at such temperatures, which is manifested by a lowering of ductility and impact resistance. It is most pronounced when the steel is tempered in the range of 850 to 1000 F and is termed "885 F embrittlement".

Semiaustenitic Precipitation-Hardenable Stainless Steels*

Properties and Uses. The precipitation-hardenable stainless steels may be divided into three broad classes; martensitic, austenitic, and semiaustenitic. The martensitic types are hardened by heating to elevated temperatures, cooling to room temperature or below, and then aging (tempering) usually in the range of 800 to 1200 F. They can be hardened to tensile strengths in the order of 200,000 psi, but have limited ductility both as hardened and as annealed. The austenitic types are hardened by (solution) annealing, rapid cooling, and aging. They are quite ductile both as annealed and as aged. They do not attain exceptional strength at room temperature, but retain a high proportion of their strength up to a temperature of about 1250 F. Both classes of steel are important in the aircraft and other industries.

Major current interest resides in the third type, the semi-austenitic class, which is readily formed as an-

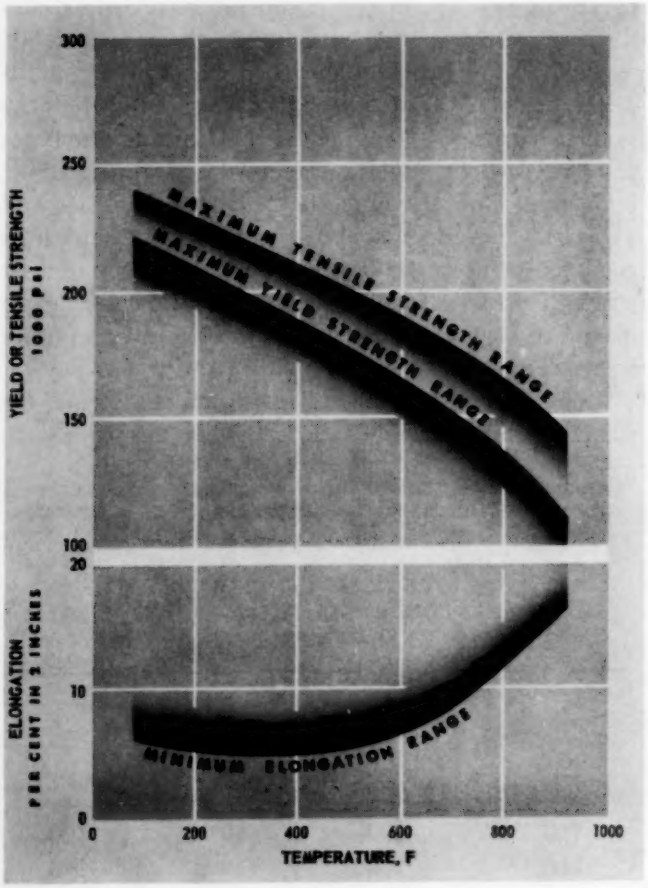
*Chromium-nickel stainless steels which are soft as annealed, but can be hardened by heating to moderate temperatures.

TABLE 3. *TYPICAL RUPTURE STRENGTHS OF SEMIAUSTENITIC PRECIPITATION-HARDENABLE STAINLESS STEELS*

Temperature, F	Stress (1000 psi) to Rupture in the Indicated Time		
	10 hours	100 hours	1000 hours
700	200	195	190
800	190	180	160
900	170	140	100

nealed and can be hardened to high strength by a number of heat treatments. These steels contain 14 to 18 per cent chromium, up to 0.15 per cent carbon, substantial amounts of nickel, and other elements such as molybdenum and aluminum. Each member of the class differs somewhat in composition from every other member. In every case, however, the composition is carefully balanced so that the alloy will be soft and ductile as annealed, but capable of attaining high strength when aged. All alloys of the class are proprietary and carry such trade designations as 17-7PH, PH15-7Mo, AM350, AM355, and 17-4Mo.

These steels are usually mill annealed at 1900 to 2000 F. They may be hardened by several treatments. For example, they may be "conditioned" at 1700 to 1750 F, then cooled to —100 F and subsequently aged. They may also be conditioned at temperatures in the order of 1375 to 1425 F, cooled to room temperature, and then aged. The former treatment produces the higher strength. Subzero cooled material is usually aged in the range of 850 to 950 F, while that conditioned at 1375 to 1425 F is commonly aged at temperatures up to 1100 F. Such heat treatments can develop



2. *Elevated-temperature tensile properties of semiaustenitic precipitation-hardenable stainless steels.*

TABLE 4. *TYPICAL CREEP STRENGTHS OF SEMIAUSTENITIC PRECIPITATION-HARDENABLE STAINLESS STEELS*

Temperature, F	Stress (1000 psi) to Produce the Indicated Permanent Strain in 1000 Hours		
	0.1 Per Cent	0.2 Per Cent	0.3 Per Cent
700	120	140	150
800	95	110	120
900	35	40	45

tensile strengths of about 185,000 to 240,000 psi, with yield strengths of 150,000 to 225,000 psi and corresponding elongation of 12 to 6 per cent, all depending on the specific alloy and heat treatment.

These steels may also be either cold rolled after annealing and then aged, or cold rolled after subzero cooling and aged. Tensile strengths to 295,000 psi with yield strengths to 290,000 psi and 1 to 3 per cent elongation are obtainable by introducing the cold-working step.

The semiaustenitic precipitation-hardenable stainless steels are used extensively in aircraft applications. Examples include supports for fuselages, stiffeners, interior frames, longerons, skin, sandwich structures, corrugated reinforced plate, liquid fuel containers, and rocket components. The steels are produced in the form of bar, sheet, strip, foil, and castings.

Practices and Problems. Fabrication and heat-treating practices vary widely, depending on the component being made and the method being used to produce it. When it is desired to make a composite structure from two different alloys in the semiaustenitic family (i.e., a brazed sandwich with PH15-7Mo face sheet and AM355 fittings), for example, a compromise heat treatment must be worked out as the two alloys do not respond alike to heat treatment. When increased ductility and toughness are required of the metal in the hardened condition, deviations from standard practice are resorted to. Thus, 17-7PH may be conditioned at 1600 F instead of 1400 F and then aged at the comparatively high temperature of 1250 F.

The steels are readily cold formed by such methods as deep drawing, spinning, hydroforming, and stretch forming. Sometimes the component can be hardened merely by aging directly after cold forming. But in most cases, the cold-forming operation strains the metal unevenly, which results in inhomogeneity of properties on hardening. Good practice then calls for use of a complete heat-treatment schedule.

In heat treating, except for a dry hydrogen atmosphere for foil, an air atmosphere is generally recommended. A problem which arises with these, as with all other hardenable steels (except those of the precipitation-hardenable austenitic class), is dimensional change accompanying heat treatment. In some cases, the problem can be alleviated by restriking parts after heat treatment. Likewise, drilling operations may be performed after hardening. Sometimes the cold-working operations can be modified to allow for, or compensate for, dimensional changes on subsequent heat treatment. Dies and fixtures may be resorted to also.

Probably the best arc-welding process for the aluminum-containing members of the family is the inert-gas-shielded method. For aluminum-free alloys, coated electrodes can be used. Preheating and post-heating are usually not required to prevent cracking in welding any of these steels because the weld-heat-affected zones are left in a ductile condition. Optimum mechanical properties are obtained by full heat treatment after welding. The steels can also be spot and seam welded.

TABLE 5. *TYPICAL RUPTURE STRENGTHS OF COLD-ROLLED AUSTENITIC STAINLESS STEELS*

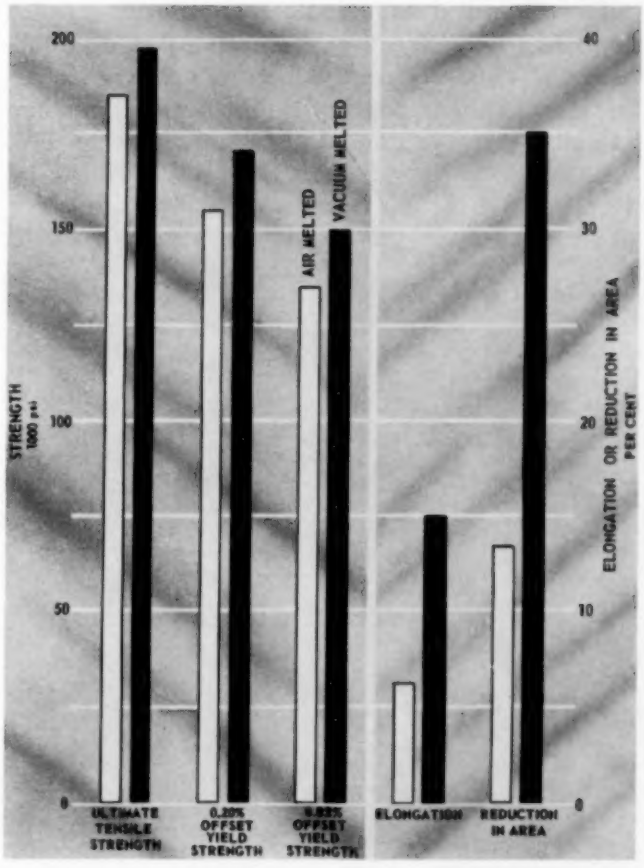
Temperature, F	Stress (1000 psi) to Rupture in the Indicated Time		
	10 Hours	100 Hours	1000 Hours
800	150	135	110
900	110	90	65
1000	75	60	45
1200	45	35	25

Cold-Rolled Austenitic Stainless Steels*

Properties and Uses. Certain austenitic stainless steels develop tensile strengths up to 290,000 psi when heavily cold rolled, and these steels are classified as the cold-rolled austenitic stainless steels. Their properties, as cold rolled, can be improved slightly by stress relieving after rolling. Among these steels being used or considered by the aircraft industry are the standard AISI 201 and 301 types. Some of the relatively newer alloys in this group are Micro Mach (a modified 301-type steel), 17-5MnV, and Tenelon.

The cold-rolled stainless steels are generally used where high strength and corrosion resistance, but little or no forming, are needed. They can be used also for short periods of time at temperatures up to about 800 F, losing little of their room-temperature strength. These steels are being considered for use in sandwich and honeycomb structures and in liquid-fueled rocket casings. AISI 301 has been used extensively for general aircraft applications for several years.

*High-chromium steels usually containing nickel and/or manganese and nitrogen, which can be hardened only by cold working.

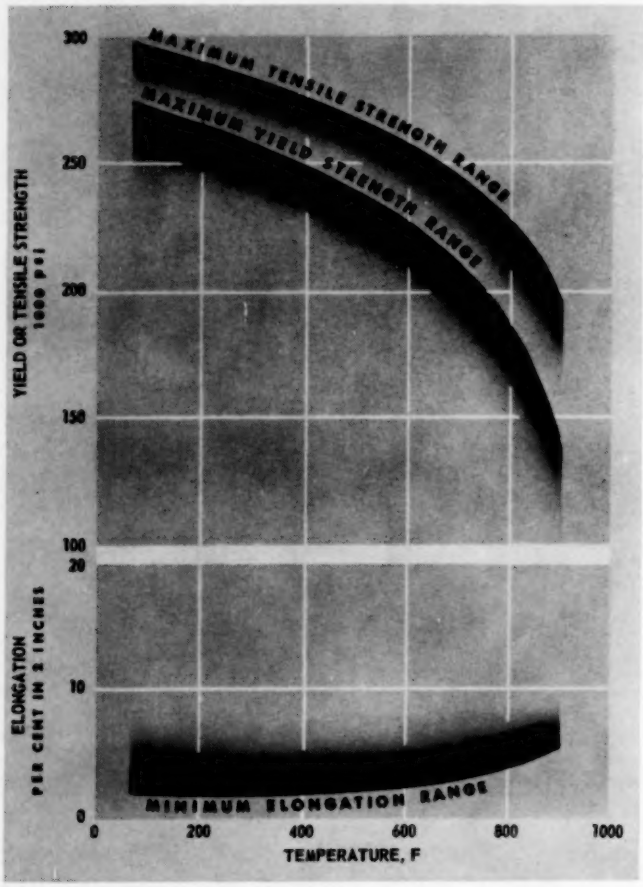


3. *A comparison of some mechanical properties of air-melted and consumable-electrode vacuum-arc-remelted AM355 in the subzero cooled and tempered condition as determined at room temperature. The improved ductility values found in the vacuum-melted materials (note elongation and reduction in area) are particularly notable.*

TABLE 6. *TYPICAL CREEP STRENGTHS OF COLD-ROLLED AUSTENITIC STAINLESS STEELS*

Temperature, F	Stress (1000 psi) to Produce the Indicated Creep Rate (per cent per hour)			
	10^{-5}	10^{-4}	10^{-3}	10^{-2}
800	50	80	120	160

The cold-rolled stainless steels are usually supplied full-hard (40 to 50 per cent reduction) or extra-full-hard (50 to 65 per cent reduction) tempers for airframe applications, but they can be supplied in others as well. These steels are available in widths up to 48 inches and thicknesses up to 0.080 inch. Sheet less than 0.010-inch thick is usually restricted to widths of about 24 inches.



4. *Elevated-temperature tensile properties of cold-rolled austenitic stainless steels.*

Practices and Problems. These steels, of course, require no heat treatment except for stress relief, which may improve ductility and strength slightly, depending on the alloy. In some of these steels, stress relieving also tends to reduce slightly the spread in longitudinal and transverse tensile properties caused by the rolling process. A somewhat greater reduction is noted in the spread of the compressive properties. Annealing prior to cold rolling is conducted at 1950 F, followed by water quenching. An air atmosphere is generally used in the annealing and stress-relieving heat treatments of these materials. Sheet under about 0.040-inch thick is air cooled to avoid distortion.

Because these steels are already heavily cold worked as supplied, they have limited formability. Therefore, their applications are restricted to those requiring mild forming operations, such as bending to large radii.

These steels, as cold rolled, can be welded readily by most of the processes suitable for other stainless steels, though the heat cancels out the strengthening effects of cold work in the weld and in most of the zone affected by the heat. Planishing Heliarc welds by cold rolling to put this region in compression yields 50 to 60 per cent joint efficiency. When the joint is reinforced with a spot-welded doubler (an extra sheet that may overlap each side of the weld zone by 3 to 4 inches), about 100 per cent joint efficiency is obtained. Spot welds have little effect on the strength.

Conclusion

A large research and development effort in high-strength stainless steels is in progress. Improvements are being made steadily. Particular attention is directed toward better transverse ductility and toughness, increased resistance toward tearing, greater uniformity of properties from heat to heat, better methods of joining and heat treating, and improvements in welding. Substantial progress is being made on these problems.

"The advance of science is not comparable to the changes of a city, where old edifices are pitilessly torn down to give place to new, but to the continuous evolution of zoologic types which develop ceaselessly and end by becoming unrecognizable to the common sight, but where an expert eye finds always traces of the prior work of the centuries past. One must not think then that the old-fashioned theories have been sterile and vain."

Henri Poincaré, *The Value of Science*

NOTES from BATTELLE

RESEARCH REPORTS LISTED

The Department of Defense, the Atomic Energy Commission, and other agencies of the Federal Government have released thousands of research reports for the use of those concerned with technological progress, Listings of all the Battelle research reports among these, which had been released to July 1, 1959, are now available with publication of *Battelle Research Reports, Supplement I.*

The compilation continues an earlier listing of the same general title. Prepared by Ralph L. Darby, Elsie G. Worls, and Linda G. Tyo, *Battelle Research Reports, Supplement I* records, with annotations, some 530 reports.

The listed reports are obtainable from the Office of Technical Services, U. S. Department of Commerce and the Library of Congress.

The recent compilation is available from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.

ROLLER BEARINGS FOR USE TO 600 F

A troublesome problem of the airframe design engineer is finding roller bearings that will stand up under ambient temperatures up to 600 F. The difficulty is increased by the presence of such factors as space limitations, heavy bearing loads, limited actuating power, and the subjection of the bearings to oscillatory motion.

Lack of data on the limitations of bearings and lubricants in the 300 to 600 F range has made expensive and time-consuming mock-up tests a necessary part of bearing selection. To meet this critical lack of data, the Air Force has been sponsoring evaluation programs to develop new bearing materials, lubricants, and design information. Just recently, Battelle completed a program in this series and established load-life characteristics for oscillating, self-aligning roller bearings of materials suitable for the 300 to 600 F temperature range. A total of 1080 bearings was evaluated to establish load-life charts.

William A. Glaeser reports that, as expected, bearing life drops off as temperatures increase. The gradual drop-off in strength appears to be related to plastic deformation and oxidation and wear. It is assumed that plastic deformation predominates at heavier loads, wear and oxidation at lighter ones.

Among materials considered for the 450 to 600 F range, M-2 tool steel and 440-C stainless steel seem most satisfactory. The latter showed better resistance to oxidation, but a greater tendency for segregation of carbides in "bands", which surface cracks tend to follow inward. Of materials for temperatures up to 450 F, the technologists found SAE 52100 satisfactory, though its life in bearings should be expected to be shorter than 440-C or M-2 tool steel.

The Battelle study indicates that a sample size of about 15 bearings is sufficient to establish a point in load-life determinations of high-temperature grease-lubricated oscillating roller bearings.

REACTOR FUEL CANDIDATE

Uranium monocarbide—until recently a "sleeper" in the research race for better nuclear fuel materials—could conceivably move ahead of uranium alloys and uranium dioxide. In any case, say R. F. Dickerson and Frank A. Rough, uranium monocarbide should be considered a promising entry in the race on the basis of recent research results. They and their colleagues, along with technologists in other research organizations, have found that uranium monocarbide, on the basis of limited data, has many points in its favor as a fuel material for the future.

Dickerson and Rough point out that uranium monocarbide has some obvious limitations. It has no resistance to corrosion by water, so it will not be suitable as a fuel for water-cooled reactors unless some means is found to improve its corrosion resistance. Moreover, powders of uranium monocarbide are highly flammable and must be handled in a special atmosphere during fabrication. Also, additonal handling problems might develop in the chemical reprocessing of spent fuel.

In comparing uranium monocarbide with metal and uranium dioxide as fuel materials, the Battelle

scientists point out the following plus factors for the former:

1. Uranium monocarbide's heat conductivity is almost identical with that of unalloyed uranium at low temperatures and about two-thirds that of uranium in the 700 C range. With a melting point of about 2315 C it is able to withstand roughly twice the amount of heat that uranium can take. Uranium monocarbide's melting point is only 400 C below that of uranium dioxide.

2. There is substantially more uranium fuel in uranium monocarbide than in equivalent amounts of uranium dioxide, an important consideration in the design of compact nuclear reactors.

3. While much information is still needed to evaluate uranium monocarbide's ability to withstand radiation damage, there is reason to believe that it will be as serviceable under operating conditions as is uranium dioxide. Research now in progress at Battelle should do much to clear up this point.

4. Uranium monocarbide, which behaves in some way like a metal and in other ways like a nonmetallic, can be processed into fuel elements by several methods. That low-cost casting is one of these speaks well for this material.

* WELDING REFRACTORY METALS

In many instances, metals with high-temperature properties are difficult to join in dissimilar combinations. Conventional fusion-welding methods lead to extensive melting or diffusion, which promotes the formation of intermetallic compounds. These methods also allow contamination of the base materials with impurities from the surrounding atmosphere. In either case, the properties of the weldment are drastically affected.

According to N. E. Weare and R. E. Monroe, ultrasonic welding offers a possible solution to the problem; the heat created in such welding is so limited that neither contamination of the metals nor intermetallic compounds result. In a study made for Wright Air Development Division, technologists have been investigating this type of welding for refractory metals.

The metallurgists found that although the method is promising, there remains much research to do. For example, the presence of cracks at the edge of the bond area is a major problem. Only stainless-steel-to-iron-to-niobium weldments have so far been crack free. The cracks appear to be caused by fatigue resulting from the high alternating stresses present at the edge of the weld area during the ultrasonic welding.

Examination of ultrasonic welds showed that welding-tip displacement and weld time, rather than clamping pressure, governed the degree of cracking. Weare and Monroe suggest that stronger bonds might be obtained if higher clamping pressures and slightly longer weld times were used along with lower tip-displacement values.

The study indicated the need to learn more about the effects of the metals' mechanical properties upon weldments, as deformation appears to increase with increasing modulus of elasticity. The technologists also note that most of the ultrasonic welds showed that cross-tension strength required improvement if wide application of the technique is to be expected. Only titanium-to-titanium and stainless-steel-to-iron-to-niobium weldments have so far shown acceptable cross-tension strength.

* Battelle staff members named to key technical posts include: *Maynard M. Baldwin,* chairman, Research Subcommittee, American Leather Chemists —American Society for Testing Materials Joint Committee on Leather; *Albert C. Beer,* member, Advisory Group for a Conference for Compound Semiconductor Research Group; *Benson G. Brand,* member, Advisory Committee of Committee D-1 on Paint, Varnish, Lacquer, and Related Products, ASTM; *Richard B. Engdahl,* chairman, Research Interest Committee, American Society of Mechanical Engineers; *Robert W. Gibson,* member, Advisory Council, Special Libraries Association; *J. Harry Jackson,* member, Technical Council, American Society for Metals; *Richard J. Lund,* chairman, Program Committee, Industrial Minerals Division, Society of Mining Engineers, AIME; *E. E. McSweeney,* member, Council, American Chemical Society; *H. R. Nelson,* chairman, Ohio Atomic Energy Advisory Committee, Department of Industrial and Economic Development, State of Ohio; *Harlan W. Nelson,* member, Council, ACS; *Loran S. O'Bannon,* vice chairman, Enamel Division *and* chairman, Meetings Committee, American Ceramic Society; *William T. Reid,* member, Solar Energy Applications Committee, ASME; *Edwin M. Sherwood,* chairman, Electrothermics and Metallurgy Division, Electrochemical Society; *John D. Sullivan,* member, Steering Committe, Materials Sciences Divisions, ASTM *and* member, Nominating Committee, Extractive Metallurgy Division, AIME.

Writings by STAFF Members

Reaction of Nitrogen With Niobium. William M. Albrecht and W. Douglas Good, Jr. U. S. Atomic Energy Commission, BMI-1360, July 6, 1959, pp. 14. (OTS–$0.75)

Reaction rates of niobium with nitrogen were determined gravimetrically from 675 to 975 C with a recording microbalance and volumetrically from 1100 to 1600 C with a modified Sieverts apparatus. Diffusion coefficients and terminal solubilities were determined from 800 to 1600 C by the concentration-gradient technique. The reaction of nitrogen with niobium follows a parabolic rate law at 675 to 1600 C.

The Fabrication of Tungsten. V. D. Barth. DMIC Report 115; PB 151071; August 14, 1959, pp. 65. (OTS–$1.75)

The outstanding strength of tungsten is illustrated by a comparison of some of its significant physical properties with those of other metals. The effects produced by heating tungsten are discussed. The most important of these changes is the ductile-brittle transition at about 200 to 400 C, and the effective recrystallization temperature at about 1500 C or above. The consolidation of tungsten by powder-metallurgy procedures and by arc melting is summarized. Considerations of importance in primary working, secondary working, and joining are also summarized.

The Role of Creep in the Gas-Pressure-Bonding Process. Stephen D. Beck and Michael A. Gedwill, Jr. U. S. Atomic Energy Commission, BMI-1351, June 23, 1959, pp. 44. (OTS–$1.50)

A theoretical method of determining the time, temperature, and pressure required for pressure bonding was proposed and then evaluated experimentally. The analysis considered only the mechanical deformation of the bonding surfaces induced by the external pressure. It was postulated that such deformations obey the power law for steady creep. The application of the law to the closure of thick-walled aluminum cylinders under gas pressure was investigated. The behavior was compared with that predicted from creep data obtained from short-time torsion creep tests.

The Reaction of Hydrogen With Zirconium-1 and -25w/o Uranium Alloys. Harold E. Bigony, J. Robert Doig, Jr., and Horatio H. Krause, Jr. U. S. Atomic Energy Commission, BMI-1359, July 6, 1959, pp. 26. (OTS–$1.)

Hydrogen-absorption isotherms were measured over the range 535 to 835 C. Heats of solution of hydrogen in the alloys were found to range from −25.9 to −47.9 kcal per mole for the 1 w/o alloy, and from −30.7 to −50.6 kcal per mole for the 25 w/o alloy. X-ray diffraction data support the interpretation that, as hydrogen is absorbed, the alloys break down to form uranium and zirconium, and the latter absorbs the hydrogen.

Design Control Overcompression in Rotary-Vane Compressors. E. O. Bransford and R. A. Stein. *ASME, Transactions, Series D, Journal of Basic Engineering, Paper No. 59-A-109* pp. 6.

In its simplest terms, the design of a compressor of a given displacement consists of selecting a particular combination of rotor and cylinder radius, cylinder length, and number of vanes. A study of the rotary-vane compressor has shown that the choice is not entirely arbitrary since thermodynamic and mechanical losses occurring in the compressor are intimately associated with these basic dimensions. One of the more important of these geometrically dependent losses was found to be potentially severe overcompression during the discharge process. An equation is developed that describes in generalized form the relation of overcompression to the dimensions of the compressor. This equation is used to evolve an energy-loss criterion for design control of this loss.

Fatigue Studies of INOR-8. Raymond G. Carlson. U. S. Atomic Energy Commission, BMI-1354, June 26, 1959, pp. 16. (OTS–$0.75)

To develop fatigue-design information for the ORNL reactor programs, a study was made of the fatigue behavior of INOR-8, a nickel-molybdenum-chromium alloy for high-temperature service. Fatigue strength was found to decrease with increasing temperature. No appreciable frequency effect was found up to 1300 F. At 1500 F, there was a definite frequency effect, for the fatigue strengths of specimens tested at frequencies of 600 and 3000 cpm were equal, while the fatigue strength for tests at a frequency of 100 cpm was substantially lower.

Fatigue Studies of Inconel. Raymond G. Carlson. U. S. Atomic Energy Commission, BMI-1355, June 26, 1959, pp. 20. (OTS–$0.75)

Fatigue strength, whether measured in stress, total strain, or plastic strain, is a function of both temperature and frequency. The relationship between stress and strain varies with cycles of stress reversal, never reaching an equilibrium condition. In addition, the strain behavior of a specimen during stress cycling is not continuous. Strain in the plastic region was found to occur in sudden, steplike increments which are predictable functions of temperature, stress, frequency, and cycles.

Plastic in the Automotive Industry. (In German.) Kunststoffe im Automobilbau. H. E. Czabon. *Automobiltechnische Zeitschrift*, v. 62, no. 2, February, 1960, pp. 47-50.

Describes properties and presently available forms of Teflon, Delrin, Neoprene, Hypalon, and Viton, and suggests possibilities for their use in automobile structural elements, electric insulation, tires, and other applications.

Needed: A Planter With Built-In Power. William C. Finley. *Pulp and Paper*, v. 34, January, 1960, pp. 66.

Experience with other mechanisms suggests that a 10-horsepower engine could be mounted directly to a planter vehicle for needed power. With such a self-propelled unit, planting could be done by one man who would ride on the vehicle, guide it, and feed seedlings into the planter mechanism. A suitable hole in the ground could be made for the planting of each seedling, using a modification of a trenching device or a rotating or a drilling type unit which would dig a hole six inches across and 18 inches deep. The soil could be replaced in the hole mechanically and tamped following the placement of the seedling in the hole at the proper depth for planting. A method for setting desired spacing of trees could be built into the planter mechanism, and some method for applying fertilizer, or water, or both, could be developed and made operable on the planter.

The Effects of Variations in Nitrogen and Manganese Content on the Structure and High-Temperature Properties of Cast X-40 Alloy. E. E. Fletcher and A. R. Elsea. American Institute of Mining, Metallurgical, and Petroleum Engineers, Metallurgical Society, *Transactions*, v. 215, no. 6, December, 1959, pp. 917-925.

Cast X-40 alloy with the lowest N content studied had a 100-hr rupture stress at 1500 F about equal to the reported

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value for the commercial alloy. Increases in N content progressively decreased the rupture strength, and with about 0.1 to 0.2% N a minimum strength was reached, but there was no accompanying change in microstructure. Further increases in N resulted in the formation of progressively increasing amounts of a lamellar, pearlitic-type structure at the grain boundaries, with accompanying increases in rupture strength, and above about 0.25 to 0.33% N, the rupture strength exceeded the normally reported values. Two series of melts representing different melting stocks exhibited minimum rupture strengths at different N contents. This suggests that some unidentified trace element not removed by vacuum melting has a strong influence on the response of this alloy to variations in N content. In a series of melts with Mn contents ranging from 0.6 to 3.2%, the material with the lowest Mn content had the highest 100-hr rupture strength at 1500 F. The Mn variations had no appreciable effect on the microstructure.

An Approach Toward Planning a Paperboard R&D Program. Leonard M. Guss and George W. James. *Paperboard Packaging*, v. 44, no. August, 1959, pp. 136-141.

Provides a guide for determining how research and development can aid the paperboard industry, how much money is being spent, how much should be spent, and in what areas the effort should be expanded to avoid missed opportunities and to prevent wasteful duplication.

Characterization of Components in Low-Temperature Lignite Tar. E. Jack Kahler, D. C. Rowlands, J. Brewer, W. H. Powell, and W. C. Ellis. *Journal of Chemical and Engineering Data*, v. 5, no. 1, January, 1960, pp. 94-97.

The classes of the chemicals in primary tar were studied. Primary tar is composed of materials that distill at temperatures from below 100 to about 350 C, as well as high-molecular-weight, pitchlike materials. All characterization work was done on distillates. Tar acids are primarily phenolic compounds. As tar bases represent only about 4% of the tar, only limited studies were made of their nature. Neutral oil, which represents more than two thirds of primary tar, is principally hydrocarbons: paraffins, olefins, and aromatics.

Plastics. E. L. Kropa and E. E. McSweeney. *Industrial and Engineering Chemistry*, v. 52, January, 1960, pp. 42A-45A.

A review of the new developments in types and in production methods of plastics. Some commercial plastics are evaluated as to the serious problems in properties and misuse by producers. The main polymers reviewed were the polypropylene films, the new thermoplastic resin polyoxymethylene, the glass-reinforced polyesters, vinyl plastics, and the fluorocarbons.

The Small Free-Piston Engine Compressor. J. H. McNinch, W. W. Vogelhuber, and R. J. McCrory. *American Gas Journal*, v. 187, January, 1960, pp. 28-30.

This discussion covers briefly the dynamic and power-generation aspects of a free-piston engine compressor intended for use in a residential air-conditioning system. The requirements of low initial cost, high efficiency, and compactness are met by the free-piston unit with its pneumatically operated fuel-injection system. It is important to note that the unit was developed for a specific application; however, this does not necessarily limit the free-piston engine compressor to residential air conditioning.

Rare Earth Compound Semiconductors. J. F. Miller, F. J. Reid, and R. C. Himes. *Electrochemical Society, Journal*, v. 106, December, 1959, pp. 1043-1046.

The selenides of La, Er, and Y, and tellurides of La, Er, Gd, and Y were prepared by direct reaction of the elements. Measured electrical characteristics indicate semiconducting behavior, with the possibility that a wide range of properties can be obtained within these series of rare earth compounds. Observed room-temperature resistivities, for example, ranged from about 10-4 ohm-cm for Ia_2Te_3 and ErSe to the insulator range for Y_2Se_3. All the compounds prepared possess high melting points (1400-2000 C) and exhibit good thermal stability. The dissociation pressure of Gd_2Te_3 at its melting point appears to be as low as 0.01 atm.

Swell Resistance of Polymer-Filler Systems to Boiling Water. Stephen Palinchak and W. J. Mueller. Paper from *Proceedings in International Rubber Conference*, November, 1959, pp. 8.

The absorption characteristics of different polymers were studied to determine the influence of fillers on water absorption and swell of the polymers. The lowest absorption and swelling was obtained with butyl, SBR-1503, and a nitrile rubber, butyl being somewhat better than the other two rubbers. The highest swelling rubber of those evaluated was brominatd butyl, followed by neoprene and SBR-1500. The addition of fillers such as carbon blacks and certain silica fillers tends to reduce the swell of the high water absorbing rubbers such as neoprene and SBR-1500.

Gas Plating. Carroll F. Powell. *Materials in Design Engineering*, v. 51, January, 1960, pp. 98-101.

This process, synonymous with vapor plating or vapor deposition, deposits coatings that cannot be electroplated or applied otherwise in a nonporous condition, can plate plastics and other nonmetallics, will plate irregular surfaces, and produce ultra high purity deposits, all at high production rates. Application methods, coating properties, and limitations of the process are discussed.

Improved Corrosion Resistance for Electroplated Die Castings. W. H. Safranek, H. R. Miller, and C. L. Faust. *46th Annual Technical Proceedings, 1959*. American Electroplaters' Society, Inc., Newark, New Jersey, pp. 8.

Use of duplex nickel and bright, crackfree chromium improves the corrosion resistance of electroplated zinc die castings. A selected duplex nickel system in place of bright nickel or 0.025 mil (minimum) of bright, crackfree chromium that is deposited in a high-ratio bath at 130 F in place of thinner chromium will extend the "corrosion free" life of plated die castings to at least one year in highly corrosive areas.

Can We Live in Babel? Ralph A. Sherman. American Association for the Advancement of Science, Washington, D. C., 1959, pp. 229-233.

Discusses the confusions and anomalies in weights and measures which exist both between nations and technologies. Concludes that, with respect for the systems of others, we can live in Babel without undue hardship.

Properties of Uranium Monocarbide. C. A. Smith and Frank Rough. *Nuclear Science and Engineering*, v. 6, November, 1959, pp. 391-395.

Specimens of uranium monocarbide of nearly theoretical density were prepared by arc melting and casting. Physical property measurements of the unirradiated materials included hardness, density, electrical resistivity, thermal conductivity, linear expansion, modulus of elasticity, and compatibility with NaK and stainless steel. One group of specimens was irradiated in the MTR to a burnup of 1400 Mwd/ton of uranium. Swelling was found to be in the range of 0.66 to 2.53%. Fission recoil from the surface of the specimens could account for the observed gas release.

Tables of Tolerance-Limit Factors for Normal Distributions. Alfred Weissberg and Glenn H. Beatty. Battelle Memorial Institute, December, 1959, pp. 42.

Tables of factors for use in computing two-sided tolerance limits are presented. In contrast to previous tabulations of the tolerance-limit factor K, the factors $r(N,P)$ and $u(f,y)$, whose product is equal to K are tabulated. This results in greatly increased compactness and flexibility. The mathematical development is discussed, including methods used to compute the tabulated values and a study of the accuracy of the basic approximation. A number of possible applications are discussed and examples given.

Powder Metallurgy. J. R. Van Orsdel. *Journal of Metals*, v. 12, January, 1960, pp. 50-51.

Describes recent advances and current developments in continuous compacting of metal powders, production of ultra-fine powders, particle size determination, bonding carbides to steel, and pressing lubricants.

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ADMINISTRATION AND PHILOSOPHY OF RESEARCH

3734* The Lady Tasting Tea, and Allied Topics. The well-known discussion of the principles of experimentation, illustrated by a taste-testing problem, in R. A. Fisher's *Design of Experiments*, is the basis of this expository paper. The notion of a hypothetical population of identical experiments is defended. ***N. T. Gridgeman.*** *American Statistical Association, Journal*, v. 54, no. 288, Dec. 1959, p. 776-783.

3735 Brighter Than a Thousand Suns. A personal history of the atomic scientists from 1918 to the present time. The author attempts to show how the personalities of these scientists affected the course of nuclear research. ***Robert Jungk.*** 369 pp. 1958. Harcourt, Brace and Company, New York. (QC773 J95htr)

3736* Improving the Management of Research. Improving the business role of research management by looking ahead, crystallizing business goals, and clarifying research objectives is based on a simple philosophy: unification of corporate goals and research goals. Then the skill of the workers, their knowledge, and their inherent urge to explore the unknown will provide new, usable technology. ***William L. Swager.*** *Business Horizons*, v. 2, no. 4, Winter 1959, p. 42-49.

3737 Handbook of Industrial Research Management. This brings together in one authoritative volume the best practice in the organization, evaluation and control of industrial research. Thirty-three experts with long and successful records in research management spell out the problems, and how they are solved. ***Carl Heyel, editor.*** 513 pp. 1959. Reinhold Publishing Corp., New York. (T175.5 H51h)

3738* Support of Basic Research by the Engineering Sciences Program of the National Science Foundation. Grants made during the past five years to the nation's universities have been made to those which have, in great part, initiated an active research interest on their own part. Because of the increasing emphasis on graduate work in the nation's engineering schools, a large increase in research activities at universities is to be expected. ***Arthur H. Waynick, K. G. Picha, Francis M. Kobayashi, and J. Nelson Reeds.*** *Journal of Engineering Education*, v. 50, no. 3, Dec. 1959, p. 207-215.

3739* The Scheduling of Engineering Research. This article briefly considers the mechanics of scheduling engineering research, the pitfalls to be avoided, the time and cost involved, and the results that can be reasonably expected. ***Raymond Villers.*** *Journal of Industrial Engineering*, v. 10, no. 6, Nov.-Dec. 1959, p. 419-422.

3740* The Engineer—Paragon or Paradox? I. His Personality. Psychologists tests show he's only moderately imaginative, tactless, impersonal; yet, he teams with co-workers to create machines that make the world go around. ***Eugene Raudsepp.*** *Machine Design*, v. 31, Dec. 10, 1959, p. 24-28.

3741* Too Many Scientists—Or Too Few? The White Paper on Scientific and Engineering Manpower in Great Britain, 1959, does not bear out the contention of Professor John Jewkes that Britain is in danger of producing too many scientists and engineers. Which view is right? ***Timothy Raison.*** *New Scientist*, v. 6, Dec. 17, 1959, p. 1258-1260.

3742 Defense Planning and Organization. An exploratory essay on the organization of the Department of Defense. ***Alain Enthoven and Henry Rowen.*** *Rand Corporation, Report P-*1640, July 28, 1959 (Rev.), 78 pp. (T13 R15r Contin.)

3743* Are Research Administrators Getting Lazy? When research departments consisted of only a few men, there was only a minimum of formal administrative procedures. Communication was perfect, because it was oral and continuous. Good ideas were evaluated continuously. Poorer suggestions were promptly investigated and, if found wanting, discarded. Unfortunately, as a research unit grows in size, personal com-

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munication among members becomes more and more difficult. A series of administrative and procedures develop. Concern with efficiency in its operations, both routine as well as non-routine, increases. The more the administrator allows himself to become involved in the mechanics of procedures at the expense of what should be his primary duties, then the lazier he is, and the less productive his department. ***Stuart Schott.*** *Research Management*, v. 2, no. 3, Autumn 1959, p. 139-147.

3744* Personnel Audits Improve Quality of Research Personnel. How California Research Corp. manages its personnel appraisal program. ***Arthur L. Lyman.*** *Research Management*, v. 2, no. 3, Autumn, 1959, p. 159-168.

3745* The Evaluation of Scientific Personnel. A survey and critique of the problem of appraising the value of scientists. The author is Executive Assistant to Director, Philips Laboratories. ***Gilbert Kelton.*** *Research Management*, v. 2, no. 3, Autumn, 1959, p. 185-198.

3746 Science and Resources. Explores the prospects and implications of technological advance. ***Henry Jarrett, editor.*** 250 pp. 1959. The Johns Hopkins Press, Baltimore. (HC55 J29s)

3747 Scientific Manpower and Education. Hearings Before the Committee on Science and Astronautics, U. S. House of Representatives, Eighty-Sixth Congress, First Session. A verbatim account of hearings on scientific manpower and education. 708 pp. 1959. U. S. Government Printing Office, Washington, D. C. (Q180.U5 Un3.237s)

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

3748 Lunar Trajectories. The status of three-dimensional lunar trajectories and techniques for treating them analytically are reviewed. The problem of a lunar satellite is treated in detail. This study is framed in the light of equipment limitation and interaction. Curves showing the interrelationship of flight parameters and also miss coefficients are presented. ***Aubrey B. Mickelwait.*** *ARS Journal*, v. 29, Dec. 1959, p. 905-914.

3749 Free Flight of a Ballistic Missile. The free flight portion of a ballistic missile trajectory is described in analytic form. A simplified analysis using a spherical, nonrotating Earth model is discussed first, and the corresponding error coefficients determined for the missile burnout variables. Necessary corrections for the Earth's rotation and oblateness are then introduced. Finally, consideration is given to the effect of gravitation anomalies and uncertainties in the fundamental geophysical constants which are found to be very small. ***Albert D. Wheelon.*** *ARS Journal*, v. 29, Dec. 1959, p. 915-926.

3750 Stabilization and Attitude Control of Satellite Vehicles. The status of concepts and techniques in the field of satellite attitude control and stabilization as reflected in the open literature of the last five years is reviewed. Stabilization by means of the gravity gradient, aerodynamic torques, and radiation pressure, is examined. Various attitude sensors and control torque generators are discussed. The sources of disturbing torques are briefly summarized. ***William E. Frye and Edward V. B. Stearns.*** *ARS Journal*, v. 29, Dec. 1959, p. 927-931.

3751 Guidance Techniques for Interplanetary Travel. The problem of guidance to near planets with low specific impulse engines is examined. Trajectories to which the vehicle must adhere in order to minimize fuel consumption are treated in order to evolve which measurable parameters are suited for guidance. Criteria are established for the judging of suitability of these measurement parameters. Various possible measurement techniques are catalogued into active electromagnetic techniques, passive electromagnetic techniques, and inertial techniques. The merits of the individual methods and the classes are studied. ***Charles D. Bock and Charles J. Mundo.*** *ARS Journal*, v. 29, Dec. 1959, p. 931-940.

3752 Radio Guidance. The radio methods of guidance depend upon communications to determine the navigational parameters of the vehicle, and to command alteration in its course. A series of nomographs are developed which present the tradeoff between the communications parameters. A set of possible system configurations derived on the basis of these tradeoff curves are examined. ***E. King Stodola.*** *ARS Journal*, v. 29, Dec. 1959, p. 940-945.

3753 Recent Progress in Inertial Guidance. A review of airborne and marine inertial navigation components and systems. ***John Hovorka, et al.*** *ARS Journal*, v. 29, Dec. 1959, p. 946-957.

3754 Principles of Doppler-Inertial Guidance. The principles of Doppler-inertial system theory and design are developed following a description of the characteristics and limitations of individual Doppler radar and inertial navigation systems. It is shown that the combined system provides improved accuracy and the capability of in-flight vertical and heading alignment. ***L. H. Dworetzky and A. Edwards.*** *ARS Journal*, v. 29, Dec. 1959, p. 967-972.

3755 Infrared Tracking. The state-of-the-art of infrared tracking and range detection capability is reviewed. Particular emphasis has been placed upon the rapid advance made in recent years. The improvement of cell detection in larger wavelength range and resultant higher scan speeds is examined. New optical materials and systems are treated. The development of space filtering is discussed. ***R. W. Powell.*** *ARS Journal*, v. 29, Dec. 1959, p. 973-980.

3756 Celestial Guidance. Treats the problems that underlie celestial guidance for cruise vehicles. The equations for the error signals are derived from star tracking based on an assumed position and local vertical reference. The problem of distinguishing a star from a noise background is also treated, and the problem of directing the telescope from a reference is examined, both from the point of view of astronautics and cruise missile guidance. ***R. B. Horsfall.*** *ARS Journal*, v. 29, Dec. 1959, p. 981-988.

3757* Notes on Thin Wing Theory at Low Supersonic Speeds. II. A Unified Numerical Method for the Calculation of the Loading on Wings With Subsonic Leading Edges. *G. J. Hancock.* *Aeronautical Quarterly*, v. 10, pt. 4, Nov. 1959, p. 319-325.

3758* Theoretical and Experimental Studies of Stall Propagation in Rows of Axial Flow Compressor Blades. A theory is developed using small perturbation concepts to predict the velocity of propagation of these stalled zones, or "stall cells" along the cascade. Results of the theory are applied to experimental data obtained by the author from 9- and 66-bladed cascades of airfoils. The theoretical results are then compared directly with the velocities of propagation measured on the cascades. ***M. D. Wood.*** *Aeronautical Quarterly*, v. 10, pt. 4, Nov. 1959, p. 345-360.

3759* The Design of an Annular Entry to a Circular Duct. Describes the design of an annular entry for the axisymmetric flow into a circular duct, shaped so that the wall velocity gradients are favorable to the development of the boundary layer flow. As a first step, the accelerating flow around a two-dimensional 90° duct bend with favorable gradients was obtained. This shape was modified and the axisymmetric flow pattern through it obtained by a combination of electrical analogue and relaxation methods and then checked by experiment. The favorable gradients were retained in the axisymmetric flow. ***J. C. Gibbings.*** *Aeronautical Quarterly*, v. 10, pt. 4, Nov. 1959, p. 361-372.

3760* Stresses Around Reinforced Elliptical Holes, With Applications to Pressure Cabin Windows. An analytical solution, using complex variable methods, is given for the problem of the stress distribution due to an elliptical hole, reinforced around its boundary, in a plane sheet subjected at infinity either to an arbitrary constant stress system or to a bending-type stress system. Numerical results were obtained for a wide range of parameters, including three different shapes of ellipse, and 10 different amounts of reinforcement. ***W. H. Wittrick.*** *Aeronautical Quarterly*, v. 10, pt. 4, Nov. 1959, p. 373-400.

3761* Russia's Nuclear Aircraft. Progress on the construction of an atomic airplane is beyond purely theoretical boundaries and has passed into the experimental phase, construction development, and experimentation with separate components. ***Yu. N. Sushkov.*** *Aircraft and Missiles*, v. 2, Dec. 1959, p. 34-38.

3762* Operational Problems of Take-Off and Landing. Four papers on automatic air traffic control, the pilot's problems, the human engineering approach, and safety and regularity in landing. ***E. W. Pike, B. O. Prowse, L. P. Coombes, and E. S. Calvert.*** *Royal Aeronautical Society, Journal*, v. 63, Dec. 1959, p. 685-708.

3763* On the Aerodynamic Design of Slender Wings. Since flow separation occurs readily from a highly swept leading edge, but gives rise in general to a steady flow, it is proposed that the rational approach to the aerodynamic design of slender wings is to attempt to control, rather than to suppress, these separations. This suggests that the leading edges should be sharp, and that the wing should be shaped so as to make them attachment lines at one attitude (the design attitude) at which classical wing theory can be applied. ***E. C. Maskell and J. Weber.*** *Royal Aeronautical Society, Journal*, v. 63, Dec. 1959, p. 709-721.

3764 The Fluid Analogy to Aerodynamic Heating. Use of hot fluids to simulate the high heat fluxes experienced by airborne vehicles and to evaluate the ultra short-time properties of structural alloys. ***T. C. McGill, J. V. Dutzi, and W. D. Ayers.*** Paper from "Short-Time High-Temperature Testing", American Society for Metals, Cleveland. 1958, p. 36-57. (TA460 Sy68s)

3765 Mass Transfer Cooling of Parachute Materials. Tests were conducted at Mach 5, pressure altitude of 100,000 feet, and stagnation temperatures of 700 to 900 F. Results indicate that coating weights on the order of the weight of the ribbons are required to give significant protection at the test conditions and that mechanical protection must be provided to the coatings to improve their efficiency. ***Rodney H. Cornish, Franklin J. Ahimaz, Charles W. Beadle, and Kenneth Foster.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-684, Sept. 1959, 87 pp. (TL507 Un3.18w Vis.)

3766 On the Stability of One-Dimensional Viscous Flows: Sound Waves and Shock Waves. The solution to the steady one-dimensional Navier-Stokes equations is presented for the case of Prandtl number equal to ¾ and constant coefficients of specific heats and viscosity; shown to be valid for ordinary air flows with free-stream Mach numbers not exceeding about two. The analysis indicates that for shock-wave flows there will always exist disturbance wavelengths, namely sufficiently large ones, for which the disturbances will tend to amplify with time. ***Louis G. Kaufman, II and Morris Morduchow.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-355, Aug. 1959, 44 pp. (TL507 Un3.18w Vis.)

3767 Three-Dimensional Lunar Mission Studies. Three-dimensional lunar trajectories were calculated by integration of the equations of motion of the classical restricted three-body problem of celestial mechanics. The calculations were used for analysis of several aspects of lunar flight including requirements for achieving lunar impact and for establishment of a close lunar satellite. The allowable errors in initial conditions for lunar missions are strongly dependent on the values of the initial injection velocity and the injection angle. ***William H. Michael, Jr. and Robert T. Tolson.*** *U. S. National Aeronautics and Space Administration, NASA Memorandum* 6-29-59L, June 1959, 38 pp. (TL782 Un3rm Vis.)

3768 Graphical Trajectory Analysis. A simple method for two-body trajectory problems is presented. The one basic graph used is composed simply of circles and straight lines. The transfer to new orbits on impulsive thrust, planar and nonplanar, is constructed on the same map. Approximations for continuous thrust and for cases of almost circular orbits are shown. ***Aaron S. Boksenbom.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-64*, Dec. 1959, 46 pp. (TL570 Un3t Vis.)

3769 Wind-Tunnel and Piloted Flight Simulator Investigation of a Deflected-Slipstream Vtol Airplane, the Ryan VZ-3RY. The characteristics of the deflected-slipstream VTOL airplane during a transition from hovering to normal flight were studied. The longitudinal, lateral, and directional stability and control characteristics of the vehicle were measured in the tunnel. The data were used for simulation to document and handling qualities of the vehicle; the simulator cockpit was free to pitch and roll. It was concluded that the airplane could perform the transition within certain boundaries. ***Harry A. James, Rodney C. Wingrove, Curt A. Holzhauser, and Fred J. Drinkwater, III.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-89*, Nov. 1959, 88 pp. (TL570 Un3t Vis.)

3770 An Analog Study of an Airborne Automatic Landing-Approach System. Analysis indicates that it is possible to control an airplane in a landing-approach maneuver by means of an automatic control scheme which derives its error signals from airborne attitude-measuring equipment and airborne radar equipment tracking a target located at the end of the runway. It is also shown that the attitude measurements needed to define the displacement errors must be measurements of Euler angles rather than the integral of body axes rotations. ***James J. Adams.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-105*, Dec. 1959, 57 pp. (TL570 Un3t Vis.)

3771 Static Force Tests of Several Annular Jet Configurations in Proximity to Smooth and Irregular Ground. Effects of changing the plan form from circular to elliptical and the effects of irregularities in the ground on the thrust augmentation of a discontinuous annular jet in ground proximity at zero forward speed. The results indicate that appreciable thrust augmentation can be obtained with a discontinuous annular jet but the augmentation decreases with increasing percentage of open area in the jet curtain. Thrust augmentation is obtained with elliptical plan forms but this augmentation is less than that of a circular plan form of the same circumference. Surface irregularities decrease the thrust augmentation with the jet very close to the ground. ***Edwin E. Davenport, Richard E. Kuhn, and Irving R. Sherman.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-168*, Nov. 1959, 13 pp. (TL570 Un3t Vis.)

3772 Spectrographic Temperature Measurements in a Carbon-Arc-Powered Air Jet. Free-stream temperatures were measured in the range 3700 to 5400 K. The method utilizes the band radiation of the cyanogen molecule and depends upon the rotational energies of this species. ***David H. Greenshields.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-169*, Dec. 1959, 24 pp. (TL570 Un3t Vis.)

3773 Lift and Drag Characteristics at Subsonic Speeds and at a Mach Number of 1.9 of a Lifting Circular Cylinder With a Fineness Ratio of 10. An exploratory wind-tunnel investigation was made at subsonic speeds and at a Mach number of 1.9 to determine the feasibility of using small flaps to develop lift for possible re-entry application. The lift effectiveness of all flaps decreased rapidly above a Mach number of 0.3 but was positive for all Mach numbers of the investigation when the flap chord was 5% or greater. The ineffectiveness of small flaps could be slightly improved at higher subsonic Mach numbers by locating them near the leading edge. ***Vernard E. Lockwood and Linwood W. McKinney.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-170*, Dec. 1959, 21 pp. (TL570 Un3t Vis.)

3774 Dynamic-Model Investigation of the Damping of Flapwise Bending Modes of Two-Blade Rotors in Hovering and a Comparison With Quasi-Static and Unsteady Aerodynamic Theories. The results of a study of the damping of a teetering and flapping rotor are presented and compared with damping values calculated from both quasi-static and unsteady aerodynamic theories. Under conditions of negligible inflow, the total damping, when plotted as a function of the ratio of blade bending frequency to rotor speed, fluctuates between upper and lower bounds given by combined quasi-static aerodynamic and structural damping and by structural damping, respectively. ***Milton A. Silveira and George W. Brooks.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-175*, Dec. 1959, 30 pp. (TL570 Un3t Vis.)

3775 Jet Effects on Longitudinal Trim of an Airplane Configuration Measured at Mach Numbers Between 1.2 and 1.8. A rocket-powered delta-wing airplane model was tested

at Mach numbers up to 1.8. The configuration tested had a relatively small horizontal tail mounted just behind and above the exit of a rocket nozzle. The results indicated that the model encountered large jet-induced effects on longitudinal trim between Mach numbers of 1.2 and 1.8. ***Robert F. Peck.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-177,* Dec. 1959, 17 pp. (TL570 Un3t Vis.)

3776 Measurements of Pressure and Local Heat Transfer on a 20° Cone at Angles of Attack up to 20° for a Mach Number of 4.95. Data were obtained in a Reynolds number range of 14 x 10^6 to 75 x 10^6 per foot based on free-stream conditions. The measured pressures were compared with the first-order and second-order approximations of exact cone theory and with Newtonian and modified Newtonian theory. The data were best predicted by Newtonian theory. The heat-transfer rates along the most windward generator of the cone increased with increasing angle of attack. ***Jerome D. Julius.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-179,* Dec. 1959, 28 pp. (TL570 Un3t Vis.)

3777 Investigation of Variation in Base Pressure Over the Reynolds Number Range in Which Wake Transition Occurs for Two-Dimensional Bodies at Mach Numbers From 1.95 to 2.92. Effects of Reynolds number upon two-dimensional base pressure throughout the Reynolds number range of wake transition. Effects of model shape and fineness ratio. Comparisons are made with the results of the mixing theory of Crocco and Lees. Results of wake disturbance tests and wake schlieren studies. The Reynolds number range was approximately from 5,000 to 6,000,000. ***Vernon Van Hise.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-187,* Nov. 1959, 44 pp. (TL570 Un3t Vis.)

3778 The Interpretation of Nonlinear Pitching Moments in Relation to the Pitch-Up Problem. Practical methods are presented for predicting the longitudinal response of an airplane to arbitrary control inputs using nonlinear aerodynamic data. These methods are used to study the pitch-up problem encountered by numerous present-day airplanes in maneuvering flight at high speeds. For a given shape of the pitching-moment curve, the severity of pitch-up is increased by either an increase in dynamic pressure or a decrease in the airplane longitudinal moment of inertia. ***George S. Campbell and Joseph Weil.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-193,* Dec. 1959, 32 pp. (TL570 Un3t Vis.)

3779 Analysis of Temperature Distribution and Radiant Heat Transfer Along a Rectangular Fin of Constant Thickness. Study of the steady-state radiant heat-transfer characteristics of rectangular fin plates of constant thickness with uniform heat source along the leading edge and no convection. Calculations of the variation of temperature and radiating effectiveness with distance from the heat source are made for infinite- and finite-length plates over a wide range of ratios of sink-to-source temperatures. Application of the solutions to a variety of environmental conditions is made possible through the determination of an equivalent sink temperature for the environment. Design parameters for minimizing plate volume are derived, and application of results to practical radiator considerations is indicated. ***Seymour Lieblein.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-196,* Nov. 1959, 60 pp. (TL570 Un3t Vis.)

See also: **4259** (hypersonic flow theory); **4389** (atom powered aircraft); **4595** (fatigue of aircraft structures).

AGRICULTURE

3780* Microbial Insecticides and Their Future. ***George Decker.*** *Agricultural Chemicals,* v. 15, Jan. 1960, p. 30 + 4 pages.

3781 Annual Review of Entomology. Neurosecretion in insects, host selection in phytophagous insects, mechanisms of resistance against insecticides, and pesticides in relation to public health. ***Edward A. Steinhaus and Ray F. Smith, editors.*** v. 5. 451 pp. 1960. Annual Reviews, Inc., Palo Alto, California. (QL461 An78 Vis.)

3782* Control of Foam During Fermentation by the Application of Ultrasonic Energy. An ultrasonic generator controlled foam adequately at 26, 29, and 34 kc/sec at medium aeration rates up to 0.6 ft^3/min. Final viable counts were in the same range as those for cultures grown using lard oil as a foam control agent. At 34 kc/sec the final viable counts were slightly higher than those of cultures with lard oil. ***Arthur E. Dorsey.*** *Journal of Biochemical and Microbiological Technology and Engineering,* v. 1, no. 3, Nov. 1959, p. 289-295.

3783* Intensive Limited Area Control of Potential Arthropod Disease Vectors. During the treatment period mosquito light trap collections showed an average daily reduction of 90%, adult mosquito landing counts 81%, mite population 76%, and general sweep collections 94%. After insecticiding stopped, mosquitoes moved back into the area quickly. The mite and general insect populations showed no signs of a buildup during the week after insecticiding stopped. ***Lafe R. Edmunds and Theodore E. Blakeslee.*** *Journal of Economic Entomology,* v. 52, no. 6, Dec. 1959, p. 1050-1053.

3784* Relationship Between Metabolism and Differential Toxicity of Malathion in Insects and Mice. Degradation of malathion is much more extensive in the mouse than in the insect and malaoxon production is correspondingly lower; these effects account satisfactorily for the low toxicity of malathion to the mouse. The low toxicity of topically applied malathion to the German cockroach is attributable to poor penetration through the integument. ***H. R. Krueger and R. D. O'Brien.*** *Journal of Economic Entomology,* v. 52, no. 6, Dec. 1959, p. 1063-1067.

3785* The Release of a Neuroactive Agent by the American Cockroach After Exposure to DDT or Electrical Stimulation. The active principle is soluble in water, methanol, and ethanol, but insoluble in nonpolar solvents. Although the chemical structure of the toxicant is unknown, it is chemically, chromatographically, and biologically distinct from acetylcholine, epinephrine, norepinephrine, histamine, γ-aminobutyric acid and 5-hydroxytryptamine. The source of the toxicant is apparently the central nervous system itself during periods of great nervous activity, whether initiated by electrical stimulation or by constant bombardment of sensory-central synapses due to excessive afferent impulses generated in the sensory nerves by direct action of DDT. ***James Sternburg, Shen Chin Chang, and Clyde W. Kearns.*** *Journal of Economic Entomology,* v. 52, no. 6, Dec. 1959, p. 1070-1076.

3786* Biological Control—Past, Present and Future. Great expansion is indicated in the use of micro-organisms of various types in the control of pests. It is concluded that there is no justification now for considering the method of biological control of decreasing value but that there will be a continued and probably increasing place for this method of control in the future. ***F. J. Simmonds.*** *Journal of Economic Entomology,* v. 52, no. 6, Dec. 1959, p. 1099-1102.

3787* Utilization of Native Parasites and Predators. In apple orchards in Nova Scotia, general use of a program of selective sprays for several years has been followed by a reduction in the amount of damage caused by important insect and mite pests. The evidence indicates that, when selective pesticides were applied, beneficial species survived in greater numbers, and in some cases increased substantially. ***A. D. Pickett.*** *Journal of Economic Entomology,* v. 52, no. 6, Dec. 1959, p. 1103-1105.

3788* Integrated Control Programs in the Future of Biological Control. Integrated control is applied pest control which combines and integrates biological and chemical control. Chemical control is used as necessary and in a manner which is least disruptive to biological control. Integrated control may make use of naturally occurring biological control as well as biological control effected by manipulated or introduced biotic agents. The development of integrated control programs opens new horizons for the utilization of natural and biological controls. ***Ray F. Smith and Kenneth S. Hagen.*** *Journal of Economic Entomology,* v. 52, no. 6, Dec. 1959, p. 1106-1108.

3789* An Evaluation of Resistance of Corn Leaf Tissue to Feeding by European Corn Borer Larvae. Five related inbred lines of field corn were evaluated for resistance to leaf

feeding by the European corn borer, *Pyrausta dubilalis* (Hubn.), using field and laboratory methods. The resistance present in the lines studied was due primarily to antibiosis. There are differences in survival of newly hatched corn borer larvae reflecting differences in planting date, stage of growth of the plants, and maturity of corn leaf tissue, as well as differences in over-all plant resistance. The use of related inbred lines has demonstrated some of the genetic implications of resistance studies. ***A. K. Burditt, Jr. and F. G. Holdaway.*** *Journal of Economic Entomology*, v. 52, no. 6, Dec. 1959, p. 1171-1180.

3790* A Quantitative Measure of Aggregation in Insects. The occurrence of insects in natural units of their habitats is best expressed as a frequency series. The negative binomial distribution has proved applicable to a wide range of insect counts, and its parameter k is a valid, readily computed measure of aggregation. Examples from hypothetical and natural populations demonstrate its utility. ***William E. Waters.*** *Journal of Economic Entomology*, v. 52, no. 6, Dec. 1959, p. 1180-1184.

3791* Field Observations on the Effects of Releasing Sterile Screw-Worms in Florida. Approximately 500 sterile male screw-worm flies were released weekly per square mile over a 2,000-square-mile area in Florida. Egg-mass collections in the treated area declined from a weekly average of 41 per station during the first 2 months to 11 in the 12th week. At the end of 3 months 70% of the egg masses were sterile. ***A. H. Baumhover, C. N. Husman, C. C. Skipper, and W. D. New.*** *Journal of Economic Entomology*, v. 52, no. 6, Dec. 1959, p. 1202-1206.

3792* Residues in Fatty Tissues, Brain, and Milk of Cattle From Insecticides Applied for Grasshopper Control on Rangeland. In 1956 cattle exposed to rangeland treated with aldrin at 2 oz. per acre for different periods averaged 1.4 to 10.9 p.p.m. of dieldrin in the fat at slaughter. In 1957 steers were exposed for 58 to 90 days to rangeland treated with 2 oz. of aldrin, 3 oz. heptachlor or ¾ oz. of dieldrin per acre, then confined in a feed lot for 93 or 100 days. Dieldrin residues from the aldrin treatment were about 4 p.p.m. in the fat when the animals were removed from the range and about 0.9 p.p.m. when slaughtered. Heptachlor epoxide residues from the heptachlor treatment were of the same magnitude. Residues from dieldrin were about 7 p.p.m. when the animals were removed from the range and 1.4 p.p.m. when slaughtered. Milk from cows exposed to range treated with heptachlor at 2 ounces per acre showed heptachlor epoxide residues of 13.3 p.p.m. in the butterfat (about 0.5 p.p.m. in the milk) after 28 days and 1 p.p.m. after 165 days. *Journal of Economic Entomology*, v. 52, no. 6, Dec. 1959, p. 1206-1210.

3793 Commercial Application of Gibberellic Acid to Hops. ***A. S. Nash and P. D. Mullaney.*** *Nature*, v. 185, Jan. 2, 1960, p. 25.

3794 Resistance of Houseflies to γ-Benzene Hexachloride and Dieldrin. ***R. G. Bridges and J. T. Cox.*** *Nature* (Suppl. No. 22), v. 184, Nov. 28, 1959, p. 1740-1741.

3795* The Inhibitory Activity of Plant Juices on the Infectivity of Potato Virus X. Juices from 26 species or varieties of plants inhibited the infectivity of the brown spot strain of potato virus X (PVX). The infectivity of PVX was wholly suppressed by juices from *Pelargonium hortorum, Chenopodium album, C. amaranticolor*, and 2 varieties of *Capsicum frutescens*. Juice of *P. hortorum* did not lose its inhibitory activity when heated 10 minutes at 100 C. When the juice of *P. hortorum* was sprayed on assay plants, inhibition was still complete when the leaves were inoculated 20 days later. ***W. Blaszczak, A. Frank Ross, and R. H. Larson.*** *Phytopathology*, v. 49, Dec. 1959, p. 784-791.

3796* Comparative Inhibition of Virus Multiplication by Certain Types of Chemicals. Two hundred and thirty-three chemicals were screened for their ability to inhibit TMV (tobacco mosaic virus) multiplication in cucumber cotyledons. More limited screening was done with stone fruit ring spot virus. The 15 chemicals effective at 1m*M* or less included 2 purine or pyrimidine derivatives (thiouracil and 2,6,8-trichloropurine); 6 dyes (methylene blue, brilliant green, crystal violet, malachite green, eosin B, and eosin Y); 1 inorganic salt (sodium selenate); 4 antibiotics (chloramphenicol, noformicin, cytovirin, and actidione); and 2 folic acid derivatives (A-methopterin and A-denopterin). Actidione was the most active chemical tested, giving 50% inhibition of TMV at only 2 ppm. ***R. C. Lindner, Hugh C. Kirkpatrick, and T. E. Weeks.*** *Phytopathology*, v. 49, Dec. 1959, p. 802-807.

3797* A Method of Freeing White Clover Plants of Bean Yellow Mosaic Virus. Terminal cuttings 1 cm long or less were obtained from clones grown at 10 C. The cuttings were rooted in sterilized sand in glass jars with the mouth covered with polyethylene. Of 362 cuttings from 45 clones grown at 10 C., 126 were virus-free. In contrast, only 18 of 317 field-grown cuttings of the same clones were virus-free. ***L. W. Baxter, Jr. and N. E. McGlohon.*** *Phytopathology*, v. 49, Dec. 1959, p. 810-811.

3798 The Chemistry of Plant Gums and Mucilages and Some Related Polysaccharides. Discusses gum function and origin. The gums are classified botanically before the text takes up their chemical and physical properties. ***F. Smith and R. Montgomery.*** 627 pp. 1959. Reinhold Publishing Corporation, New York. (QD419 Sm56c)

See also: **4835** (soil chemistry of cesium 137).

BIOCHEMISTRY AND BIOPHYSICS

3799 Environmental Control Systems for Manned Space Vehicles. ***Richard A. Nau.*** *American Society of Mechanical Engineers, Paper No.* 59-AV-11, 1959, 9 pp. (TJ1 Am35p Vis.)

3800 Environmental Requirements for Extended Occupancy of Manned Satellites. ***S. H. Dole.*** *American Society of Mechanical Engineers, Paper No.* 59-AV-12, 1959, 12 pp. (TJ1 Am35p Vis.)

3801 Psycho-Physiologically Centered Space-Vehicle Design. ***A. J. Cacioppo.*** *American Society of Mechanical Engineers, Paper No.* 59-AV-13, 1959, 6 pp. (TJ1 Am35p Vis.)

3802 Logistic Support to Man's Ecology in Space. ***John E. Mangelsdorf.*** *American Society of Mechanical Engineers, Paper No.* 59-AV-56, 1959, 24 pp. (TJ1 Am35p Vis.)

3803* Antibacterial Synergism Between the Halogenated Biphenols and the Halogenated Aromatic Anilides and Carbanilides. ***D. R. Noel, R. E. Casely, W. M. Linfield, and L. A. Harriman.*** *Applied Microbiology*, v. 8, no. 1, Jan. 1960, p. 1-4.

3804* Virucidal Activity of β-Propiolactone Vapor. II. Effect on the Etiological Agents of Smallpox, Yellow Fever, Psittacosis, and Q Fever. A 15-min exposure to a concentration of 1 mg or more of β-propiolactone per L of air is sufficient to inactivate the viruses of smallpox, yellow fever, psittacosis, and the rickettsia *Coxiella burnetii*. This activity against a variety of viruses which differed in morphology, pathogenicity, and relative stability suggests that BPL vapor is a general viral and rickettsial disinfectant. ***Frederick W. Dawson, Robert J. Janssen, and Robert K. Hoffman.*** *Applied Microbiology*, v. 8, no. 1, Jan. 1960, p. 39-41.

3805* The Electronic Structure of the Purine-Pyrimidine Pairs of DNA. Quantitative differences exist in a number of electronic properties associated with adenine-thymine (AT) and the guanine-cytosine (GC) pairs. The GC pair should be both a better electron donor and a better electron acceptor than the AT pair. The resonance energy and the complementary stabilization due to H bonding should also be greater in the GC pair. From the point of view of chemical reactivity the purine components of the pairs should be more reactive than the pyrimidine ones. Finally, the nucleophilic reactivity of the ring nitrogens should be greater in the guanine nucleus of the GC pair than in the adenine nucleus of the AT pair. On the whole, the GC pair seems to constitute from the point of view of a number of electronic indices a more important component of DNA than the AT pair. ***Bernard Pullman and Alberte Pullman.*** *Biochimica et Biophysica Acta*, v. 36, no. 2, Dec. 1959, p. 343-350.

3806* Studies on the Incorporation of 5-Fluorouracil Into a Virus Nucleic Acid. The proportion of uracil replaced varies from 28 to 47%. The amounts of other bases are unchanged. The base composition of the progeny of the substituted virus is normal. ***Milton Paul Gordon and Matthys Staehelin.*** *Biochimica et Biophysica Acta,* v. 36, no. 2, Dec. 1959, p. 351-361.

3807* Preparation and Properties of a Ribonucleoprotein Isolated From *Escherichia coli*. *David Elson.* *Biochemica et Biophysica Acta,* v. 36, no. 2, Dec. 1959, p. 362-371.

3808* Latent Enzymic Activity of a Ribonucleoprotein Isolated From *Escherichia coli*. A ribonucleoprotein preparation isolated from *E. coli* possesses both RNase and DNase activity. Evidence is presented which indicates that the enzymes are tightly bound to the nucleoprotein and are probably not contaminants. Essentially all of the RNase activity of the initial crude cell extract appears to be associated with the nucleoprotein. Both enzymes are latent, in that the intact nucleoprotein shows neither RNase nor DNase activity. Enzymic activity appears under conditions where the nucleoprotein structure is destroyed. ***David Elson.*** *Biochimica et Biophysica Acta,* v. 36, no. 2, Dec. 1959, p. 372-386.

3809* Induction of Phage Formation in Protoplasts Derived From a Lysogenic Organism. Protoplasts derived from *B. megatherium* are inducible to produce free bacteriophage, therefore the cell wall is not the site of induction. An unknown component of partially purified bovine serum albumin blocks phage development in protoplasts but not in intact cells. ***Ernest Borek and Ann Ryan.*** *Biochimica et Biophysica Acta,* v. 36, no. 2, Dec. 1959, p. 386-389.

3810* Abnormal Human Haemoglobins. III. The Chemical Difference Between Normal and Sickle Cell Haemoglobins. Tryptic digests of normal human and sickle cell hemoglobins contain a peptide fragment (peptide 4) which apparently alone of all the peptides has a different chemical structure in the two hemoglobins. The sole alteration is the replacement of a glutamic acid residue of normal hemoglobin by valine in sickle cell hemoglobin. ***V. M. Ingram.*** *Biochimica et Biophysica Acta,* v. 36, no. 2, Dec. 1959, p. 402-411.

3811* Platelet Life Span in Normal, Splenectomized and Hypersplenic Rats. The platelet life span was the same in normal, splenectomized and hypersplenic rats. ***Peter F. Hjort and Helen Paputchis.*** *Blood,* v. 15, Jan. 1960, p. 45-51.

3812* Proteases of Human Leukocytes. Three proteolytic enzymes are present; one with an optimum at approximately pH8 is inhibited by organophosphorus compounds and resembles chymotrypsin. This enzyme is derived from polymorphonuclear leukocytes. Lymphocytes contain two proteases with pH optima of 3.0 and 5.5, respectively. ***L. A. Mounter and Wasfi Atiyeh.*** *Blood,* v. 15, Jan. 1960, p. 52-59.

3813* Studies in Leukemia. XII. Interference and Reactivation Experiments With Cell-Free Tissue Extracts of Leukemic Swiss Mice. The virulence of the Swiss mouse leukemia agent can be enhanced by rapid brain to brain passages. The existence of an occult agent in the tumor tissue is demonstrable by interference and reactivation experiments. Tumor extracts inhibit the leukemogenic activity of brain homogenates of leukemic mice. Mixtures of tumor extracts and heat-inactivated brain extracts, neither of which is capable of inducing leukemia alone, have leukemia-inducing activity. A heat-labile inhibitor is probably responsible for the masking of the virus in tumor extracts. ***Joseph G. Sinkovics, Wilma A. Spurrier, and Steven O. Schwartz.*** *Blood,* v. 15, Jan. 1960, p. 95-102.

3814* Distinctive Myeloma Globulins Associated With a New Plasma Cell Neoplasm of Strain C_3H Mice. Increased amounts of proteins with β globulin and fast γ globulin electrophoretic mobility were the most striking electrophoretic findings. These components comprised as much as 35% of the serum proteins in animals with large neoplasms. Serum ultracentrifugal analyses also demonstrated a markedly abnormal distribution of the serum proteins. Normal mouse serum contains components with sedimentation coefficients ($S_{20,w}$) of 4, 6.5 and 16 S. Serum of mice bearing neoplasm 5647 contained, in addition to the normal components, proteins with sedimentation coefficients of 9, 11 and 13 S. These serum components, accounting for as much as 20% of the total protein, have been found only with neoplasm 5647. ***John L. Fahey, Michael Potter, Frederick J. Gutter, and Thelma B. Dunn.*** *Blood,* v. 15, Jan. 1960, p. 103-113.

3815* A "Polyoma" Virus Derived From a Mouse Leukaemia. *G. Negroni, R. Dourmashkin, and F. C. Chesterman.* *British Medical Journal,* no. 5163, Dec. 19, 1959, p. 1359-1360.

3816* Prolonged Survival of a Bone-Marrow Graft Resulting in a Blood-Group Chimera. A patient was treated with a bone-marrow transfusion from her sister. Evidence is presented to show that the bone-marrow graft survived for more than six months, and was responsible for the production of an increasing proportion of the patient's erythrocytes. A skin graft was undertaken between the donor of the marrow and the patient, but it was not successful. ***J. O. W. Beilby, Irene S. Cade, A. M. Jelliffe, Dorothy M. Parkin, and J. W. Stewart.*** *British Medical Journal,* no. 5166, Jan. 9, 1960, p. 96-99.

3817* Modification of the Radiation Response Determined by Single-Cell Technics: Actinomycin D. Actinomycin D enhanced the killing effect of X-rays on single HeLa cells exposed to the drug just before or after irradiation and during clone formation. ***Robert E. Bases.*** *Cancer Research,* v. 19, no. 11, Dec. 1959, p. 1223-1229.

3818* Dorland's Illustrated Medical Dictionary. 23 Ed. 1598 pp. 1957. W. B. Saunders Company, Philadelphia. (R121 D73a23)

3819* Isolation of "Biologically Intact" Mast Cells. Rat peritoneal mast cells were isolated by differential centrifugation in Ficoll (a polysaccharide of high molecular weight) dissolved in isotonic salt solution. Cells thus isolated retained their histamine in spite of repeated washing and subsequent incubation at 37 C, and reacted by disrupting to agents like compound 48/80 and antigen. ***B. Uvnäs and Inga-Lisa Thon.*** *Experimental Cell Research,* v. 18, no. 3, Nov. 1959, p. 512-520.

3820 Family Planning, Sterility, and Population Growth. Presents the results of a first study to obtain approximations of facts about how many children couples want, and to what extent this differs from the number they expect either because they are physically unable to reach the wanted number or because they exceed the wanted number through unwillingness to adopt family-limitation methods or through failure to use them effectively. ***Ronald Freedman, Pascal K. Whelpton, and Arthur A. Campbell.*** 515 pp. 1959. McGraw-Hill, New York. (HQ766 F87s)

3821* Evaluating Hot Environments. . . . in terms of human needs for comfort and effectiveness. ***Richard F. Scherberger.*** *Industrial Medicine and Surgery,* v. 29, Jan. 1960, p. 16-19.

3822* The Physiological Effects of Heat. . . . on the human body. ***Jay B. Moses.*** *Industrial Medicine and Surgery,* v. 29, Jan. 1960, p. 20-23.

3823 Industrial Microbiology. Describes the use of microorganisms as reagents to produce desirable end products having possible or well-defined industrial uses and applications. An attempt is made to present the principles and the general methods of operation. In addition to the consideration of the organisms and biochemical reactions concerned in the better-known industrial fermentations now in use, a few fermentations of present theoretical interest but perhaps potentially capable of technical development are also discussed. ***Samuel Cate Prescott and Cecil Gordon Dunn.*** 3rd Ed. 945 pp. 1959. McGraw-Hill, New York. (QR151 P92i)

3824 International Review of Cytology. The structure of cytoplasm, wall organization in plant cells, the fibrous components of connective tissue with special reference to the elastic fiber, trace elements in cellular function, and Na and K movements in nerve, muscle, and red cells. ***G. H. Bourne and J. F. Danielli, editors.*** v. VIII. 541 pp. 1959. Academic Press, New York. (QH581 In8 Vis.)

3825* A Method of Achieving Photosynthesis in a Stainless Steel Fermentor. ***C.-G. Hedén and K. Levin.*** *Journal of Biochemical and Microbiological Technology and Engineering*, v. 1, no. 3, Nov. 1959, p. 303-309.

3826* Distribution of Bacterial Cells Within Fibrous Air Sterilization Filters. Study of the effects of the diameter, volume fraction, and moisture content of the glass-fiber on the longitudinal distribution of bacterial cells. ***Shuichi Aiba, Tohru Kodama, and Hideo Sakamoto.*** *Journal of Biochemical and Microbiological Technology and Engineering*, v. 1, no. 3, Nov. 1959, p. 325-334.

3827* Autoradiographs of Pollen Tube Nuclei With Calcium-45. The results indicate that Ca^{45} can form rather stable linkages within the chromosome, probably with the nucleoprotein. The nature of such linkages is still an open question. Although there are several possibilities, a number of studies suggest that divalent metals are bound preferentially by the phosphate groups of the DNA. ***Dale Steffensen and John A. Bergeron.*** *Journal of Biophysical and Biochemical Cytology*, v. 6, no. 3, Dec. 1959, p. 339-342 + 2 plates.

3828* Observations on the Fine Structure of Type 5 Adenovirus. ***M. A. Epstein.*** *Journal of Biophysical and Biochemical Cytology*, v. 6, no. 3, Dec. 1959, p. 523-526 + 1 plate.

3829* Mixed Bacterial Infections in Relation to Antibiotic Activities. IV. *Shigella-Escherichia coli* Infections. In mixed peritoneal infections, the antibiotic activity of the *E. coli* 534 was clearly effective in ridding the peritoneal cavity of the susceptible Shigella strain. In the *enteric* mixed *E. coli* infections, however, antibiotic activity of the 534 strain failed to reveal any striking protection against lethal disease with the pathogenic *E. coli* organism. ***Dvora Rakover Friedman and Seymour P. Halbert.*** *Journal of Immunology*, v. 84, no. 1, Jan. 1960, p. 11-19.

3830* Electrophoretic Studies on the Serum Protein Pattern of the Germfree Rat and Its Changes Upon Exposure to a Conventional Bacterial Flora. Compared to the values found in conventional rats, the germfree animals show lower α-2, β- and γ-globulin values, but higher albumin levels. After one week of exposure the ex-germfree rats demonstrated an increase of the serum α-2 fraction followed in the second week by an increase in the β fraction. Only after more than 2 weeks of exposure the serum γ-globulin fraction was found to increase. ***Bernard S. Wostmann and Helmuth A. Gordon.*** *Journal of Immunology*, v. 84, no. 1, Jan. 1960, p. 27-31.

3831* Studies on Antibody Production by Spleen Explants Maintained *in Vitro*. Spleen of rats given one intravenous dose of a particulate antigen were studied. Antibody was synthesized, as evidenced by a rise in antibody content in the tissue culture medium, and incorporation of a radioactive amino acid by material specifically bound to antigen. This synthesis is accompanied by cellular differentiation similar to that described *in vivo* during antibody synthesis, but mitoses are not present. ***Mariano F. La Via, Stanley A. Uriu, and Lloyd A. Ferguson.*** *Journal of Immunology*, v. 84, no. 1, Jan. 1960, p. 48-53.

3832* Passive Cutaneous Anaphylaxis Reactions With a Systemic Lupus Erythematosus Serum Factor and Isolated *DNA*. Data provide additional evidence for the concept that the DNA-precipitating γ-globulin, present in a number of SLE sera, may be an antibody to DNA. ***Helmuth R. G. Deicher, Halsted R. Holman, Henry G. Kunkel, and Zoltan Ovary.*** *Journal of Immunology*, v. 84, no. 1, Jan. 1960, p. 106-111.

3833* Drug Latentiation. Drug latentiation is defined as the chemical modification of a biologically active compound to form a new compound, which upon *in vivo* enzymatic attack will liberate the parent compound. The chemical alterations of the parent compound are such that the change in physicochemical properties will affect the absorption, distribution, and enzymatic metabolism. ***N. J. Harper.*** *Journal of Medicinal and Pharmaceutical Chemistry*, v. 1, no. 5, Oct. 1959, p. 467-500.

3834* Inhibition by Puromycin of Amino Acid Incorporation Into Protein. Structural similarities between the broad-spectrum antibiotic puromycin and the amino acid-bearing end of S-RNA are discussed. Puromycin was found to inhibit the incorporation of leucine-C^{14} into protein in a cell-free preparation from rat liver. ***Michael B. Yarmolinsky and Gabriel L. de la Haba.*** *National Academy of Sciences, Proceedings*, v. 45, Dec. 1959, p. 1721-1729.

3835* Characteristics of a High Frequency of Recombination (HFR) Strain of *Salmonella typhosa* Compatible With *Salmonella*, *Shigella*, and *Escherichia* Species. ***L. S. Baron, W. F. Carey, and W. M. Spilman.*** *National Academy of Sciences, Proceedings*, v. 45, Dec. 1959, p. 1752-1757.

3836* Isolation of Infectious Deoxyribonucleic Acid From SE Polyoma-Infected Tissue Cultures. ***G. A. DiMayorca, et al.*** *National Academy of Sciences, Proceedings*, v. 45, Dec. 1959, p. 1805-1808.

3837 Flow Properties of Biological Systems. Highlights from reports given at a meeting, under the joint auspices of the Faraday Society and the British Society of Rheology, which was held in September, 1959, at the University of Oxford. On the first day, the flow properties of various biological systems were discussed, while the second day was devoted entirely to blood and blood vessels. ***G. W. Scott Blair.*** *Nature*, v. 184, Nov. 14, 1959, p. 1539-1540.

3838 Formation of Different Cell-Virus Relationships in Tumour Cells Induced by Polyoma. Experiments show that a genetically homogeneous line of polyoma virus can induce the formation of various tumors with different rates of release of virus, and in some tumors, no release at all. The possibility of virus induction from a pro-virus state, the existence of immunity to super-infection, and the behavior of single-cell clones of tumor cells releasing virus and not releasing virus is being studied. For such investigations the polyoma virus provides an unusually favorable system, since a plaque assay for the virus has been developed (the existence of non-infectious incomplete particles can be determined by haemagglutination), and tumor cells with widely different cell-virus relationships, can be readily and regularly established and studied in culture. ***Leo Sachs and Ernest Winocour.*** *Nature*, v. 184, Nov. 28, 1959, p. 1702-1704.

3839 Mutation of Bacteria at High Levels of Survival by Ethyl Methane Sulphonate. Using a highly purified specimen it was possible to treat *B/r* strain *E. coli* with a 0·3 *M* solution for 30 min. while retaining virtually 100% viability. The yield of mutant *B/r/6* colonies obtained after such a treatment rose to $10{,}740/10^7$ cells plated after 15 divisions of the treated cells. ***Anthony Loveless and Sheila Howarth.*** *Nature*, v. 184, Dec. 5, 1959, p. 1780-1782.

3840 Genetic Basis of the Thalassaemia Diseases. Thalassaemia is a mutation of either the α or the β hemoglobin gene, of the same kind as that observed in the abnormal adult hemoglobins, but without effect on the electrophoretic behavior of the protein. Such mutations would be expected to reduce, sometimes to nothing, the rate of production of that hemoglobin. ***V. M. Ingram and A. O. W. Stretton.*** *Nature*, v. 184, Dec. 19, 1959, p. 1903-1909.

3841 Complementation Among the Sub-Genic Mutants in the *r*-Locus of *Drosophila melanogaster*. The occurrence of inter-allelic complementation in organisms ranging from bacteria to *Drosophila* emphasizes that it is a fundamental characteristic of gene structure and function. It implies that the linear sequence of the hereditary units is not only applicable to the arrangement of genes on chromosomes, but also is probably equally true of the ultimate organization of the genic substructure in terms of cistrons and nucleotides. ***O. G. Fahmy and Myrtle J. Fahmy.*** *Nature*, v. 184, Dec. 19, 1959, p. 1927-1929.

3842 Kinetics of Virus Protein and Ribonucleic Acid Biosynthesis. Tobacco mosaic virus is synthesized *de novo*. The maximum time required for the synthesis of a tobacco mosaic virus rod is about 5 min.; unfinished virus never exceeds about 0.1% of the tobacco mosaic virus in the leaf. Virus protein and ribonucleic acid complements are synthesized from their respective precursors (free amino-acids and ribonucleotides) concurrently, at approximately equal rates. At least near one end of the rod tobacco mosaic virus protein and ribonucleic acid are synthesized by a process of linear exten-

sion. ***Barry Commoner, James A. Lippincott, and Janey Symington.*** *Nature,* v. 184, Dec. 26, 1959, p. 1992-1998.

3843 A Re-Examination of Theories. . . . of tobacco mosaic virus replication. The major requirement is that in tobacco mosaic virus replication biosynthesis of virus protein and ribonucleic acid, and formation of their specific structural arrangement in the virus rod, proceed in synchrony. A formal consideration of the geometry of the tobacco mosaic virus rod shows that there is no way of meeting this requirement other than by means of linear extension of the tobacco mosaic virus rod. Linear analysis of isotope distribution within the rod offers the first direct experimental evidence that tobacco mosaic virus biosynthesis may proceed in this fashion. ***Barry Commoner.*** *Nature,* v. 184, Dec. 26, 1959, p. 1998-2001.

3844 Damage by Streptomycin to the Cell Membrane of *Escherichia coli*. Streptomycin does not directly damage the existing membrane, but rather causes defects in membrane formed in its presence by streptomycin-sensitive cells. The action of streptomycin on membrane formation is thus analogous to that of penicillin on bacterial wall formation. ***Nitya Anand and Bernard D. Davis.*** *Nature,* v. 185, Jan. 2, 1960, p. 22-23.

3845 Uptake of Streptomycin by *Escherichia coli*. The mechanism of streptomycin action proposed here provides an explanation for the well-known and puzzling synergism observed between streptomycin and other bactericidal agents. A drug that damages the permeability barrier of a cell would promote the entry of other drugs. ***Nitya Anand, Bernard D. Davis, and Alan K. Armitage.*** *Nature,* v. 185, Jan. 2, 1960, p. 23-24.

3846 'Carcinolipin': An Endogenous Carcinogenic Substance. "Carcinolipin" seems to possess a general role of a growth-promoting factor in tissues and other biological materials, since it stimulates the growth of young rats and chickens when added to their diet. Probably it is capable of inducing malignant growth only in certain circumstances, which are being investigated further. ***J. Hradec and J. Kruml.*** *Nature,* v. 185, Jan. 2, 1960, p. 55.

3847 An Alternative Mechanism for Chemical Protection Against Radiation Damage. Suggests that chemical protection has the following basis. In the course of radiation some of the transition metal constituents of the organism are ejected from their normal sites by radiation. These are then more or less free to enter the circulation and do so in an amount sufficiently large to poison many of the metal ion-inhibited enzymes such as adenosine triphosphatase, carbonic anhydrase, arginase, etc. In the presence of the protective agent the "outlaw" metal ions are tied up in the form of chelates which are more stable than the complexes formed with the enzyme. Thus no inhibition of such enzymatic processes can occur. ***Mark M. Jones.*** *Nature,* v. 185, Jan. 9, 1960, p. 96-97.

3848 Withdrawal of Inhibition of Mitosis as a Mechanism Influencing Normal and Pathological Growth. ***J. T. Hemingway.*** *Nature,* v. 185, Jan. 9, 1960, p. 106-107.

3849 Native Protein, an Immunizing Agent Against Virus Infection. Results suggest the formation of "protective substances" within the plant. As no result was obtained when the protein inoculations were done immediately before tobacco mosaic virus infection, direct inhibiting effect does not seem to be the cause. The increase in the depressing effect observed after two protein applications, and after four days, as compared to one and two days, seems to suggest an analogy with antibody formation in animals. ***G. Loebenstein.*** *Nature,* v. 185, Jan. 9, 1960, p. 122-123.

3850 Multiplication of Vaccinia Virus in Serum-Free and Serum-Containing Cell Cultures. After four passages in serum-free cells, the virus has not yet shown a greatly diminished infectivity for rabbits, as has been reported in other serum-containing lines. ***Robert W. Pumper, Lawrence J. Alfred, and David L. Sackett.*** *Nature,* v. 185, Jan. 9, 1960, p. 123-124.

3851 Chromium Ribonucleoprotein From Bovine Liver. A fraction was prepared which contained 1080 μgm of Cr per gm dry weight, a 20,000-fold enrichment over the concentration of this metal in whole liver. The material was shown to be composed of 70% ribonucleic acid, 30% protein and 4·0% P. In addition to Cr, it also contained very substantial quantities of Ca, Mg, Sr, Ba, Al, Fe, Ni, and Zn. ***W. E. C. Wacker and B. L. Vallee.*** *Nature* (Suppl. No. 18), v. 184, Oct. 31, 1959, p. 1399.

3852 Unimpaired Mitosis in Cells With Modified Deoxyribonucleic Acid. ***Rolla B. Hill, Klaus G. Bensch, and Donald W. King.*** *Nature* (Suppl. No. 18), v. 184, Oct. 31, 1959, p. 1429-1430.

3853 Condensation Processes for the Extraction of Radioactivity From Air. Condensation processes can be used to remove radioactivity from large quantities of air with a high degree of efficiency. ***Rama.*** *Nature* (Suppl. No. 23), v. 184, Dec. 5, 1959, p. 1789-1790.

3854 Biological Properties of Coal and Coal Extracts. A crude extract proved bacteriostatic towards both Gram-positive and Gram-negative bacteria, although the former were more sensitive. B. *subtilis* was strongly inhibited, serial dilution tests showing the minimum concentration of solute required to produce bacteriostasis to be 30 μgm./ml. in plain nutrient broth, and 90 μgm./ml. in the presence of 10% v/v sterile bovine serum. The plant pathogens *Corynebacterium fascians* and *Agrobacterium tumefaciens* were also much affected, and activity against saprophytic and plant-pathogenic fungi has been confirmed. ***A. A. Mills.*** *Nature* (Suppl. No. 24), v. 184, Dec. 12, 1959, p. 1885-1886.

3855 Growth Inhibition of Mouse Ascites Tumour Cells by Powdered Tragacanth (*Tragacanthae pulvis*, B.P.) By intraperitoneal injection into a three-day-old Landschutz ascites tumor in *C* + male mice, three mgm. tragacanth powder increased the longevity of the mice in the ratio 33:18; and in another experiment two mgm. of the powder tested against 3-day-old tumors gave a longevity increase of 54:19. ***E. M. F. Roe.*** *Nature* (Suppl. No. 24), v. 184, Dec. 12, 1959, p. 1891.

3856 Inhibition of Rous I Sarcoma Metastases by a Copper-Catalyst Blocking Agent. ***B. M. Jones.*** *Nature* (Suppl. No. 25), v. 184, Dec. 19, 1959, p. 1963-1964.

3857* The Genesis of Cancer and Possible Interference With Its Growth. Proposes that cancer is a healing attempt of the organism, brought on by chronic noxae whose constant action prevents the healing attempt from being completed, and suggests that cancer will be curable by artificially inducing cell division. ***Alexander Berglas.*** *New York Academy of Sciences, Transactions,* v. 22, no. 2, Dec. 1959, p. 83-95.

3858* Shortening of the Life Span of Mice by Irradiation With X-Rays and Treatment With Radiomimetic Chemicals. The life span of CBA mice was greatly reduced by exposure to 600, 1100, and 1300 r of X-rays given in two to four sessions 3 weeks apart. The radiation does not hasten typical changes seen in unirradiated aging animals, such as alterations in collagen and the appearance of a liver lesion. ***Peter Alexander and Dorothea I. Connell.*** *Radiation Research,* v. 12, no. 1, Jan. 1960, p. 38-48.

3859* Mutation as a Cause of Death in Offspring of Irradiated Rats. The major cause of increased infant death in combined litters from conceptions at all times following irradiation was found to be indirectly genetic, i.e., a result of reduced litter size. However, a significant increase in death among litters conceived at 5 to 8 days after irradiation could be attributed to direct genetic causes. ***J. F. McGregor, A. P. James, and H. B. Newcombe.*** *Radiation Research,* v. 12, no. 1, Jan. 1960, p. 61-66.

3860* The Leeuwenhoek Lecture. Viruses: Retrospect and Prospect. ***F. C. Bawden.*** *Royal Society, Proceedings,* v. 151, ser. B, Dec. 9, 1959, p. 157-168.

3861* A Study of the Differences Between Widely Separated Populations of *Chironomus* (= *Tendipes*) *tentans* (Diptera). The banding patterns of giant chromosomes of Canadian *C. tentans* differ from the European much more than those of the European or Canadian larvae differ among themselves. It is possible to make hybrids between imagines from the two continents and there is little, or no, reduction

in fertility. ***A. B. Action.*** *Royal Society, Proceedings,* v. 151, ser. B, Dec. 9, 1959, p. 277-296.

3862 A View of Genetics. The experimental control of cellular genotype is one of the measures of the scope of genetic science. However, nucleic genes can not be readily approached for experimental manipulation except by reagents that mimic them in periodic structure. Specifically induced mutation, if ever accomplished, will then consist of an act of genetic recombination between the target DNA and the controlled information specified by the reagent. Methods for the step-wise analysis and re-assembly of nucleic acids are likely to be perfected in the near future in pace with the accessibility of nucleic acid preparations, which are homogenous enough to make their use worth while. ***Joshua Lederberg.*** *Science,* v. 131, Jan. 29, 1960, p. 269-276.

3863 Nuclear Control of the Cell. ***Helen Gay.*** *Scientific American,* v. 202, no. 1, Jan. 1960, p. 126 + 8 pages.

3864* Inhibition of Foreign Spleen Reaction by Inactivation of Donor Cells With Recipient Antigen. C57BL mouse spleen cells incubated with (C57BL x 101)F_1 liver homogenate killed only 17% of sublethally irradiated (C57BL x 101)F_1 recipients, whereas, when incubated with C57BL liver homogenate or injected without incubation such cells killed 100% of sublethally irradiated (C57BL x 101)F_1 recipients within 35 days. Although the immunologically inactivated spleen cells showed a decreased ability to kill, circulating donor-type erythrocytes were found in surviving recipients, indicating repopulation of the bone marrow by surviving graft-derived stem cells. ***G. E. Cosgrove, A. C. Upton, R. A. Popp, and C. C. Congdon.*** *Society for Experimental Biology and Medicine, Proceedings,* v. 102, no. 3, Dec. 1959, p. 525-527.

3865* Bacterial Polysaccharide, Cortisol, and Acute Leukemia in the Rat. *K. pneumoniae* polysaccharide, injected intravenously, cures rats with leukemia due to Murphy-Sturm lymphosarcoma cells. Cortisol administration markedly inhibits the anti-leukemic effect of the bacterial polysaccharide. Resistance to tumor cells follows the polysaccharide-induced recovery from leukemia. ***Claude R. Thomas and Russell S. Jones.*** *Society for Experimental Biology and Medicine, Proceedings,* v. 102, no. 3, Dec. 1959, p. 537-539.

3866* Studies on a Virus ("Polyoma") Inducing Multiple Tumors in Animals. In ultrathin sections of mouse (NIH-Swiss and Af/Dm strain) embryo cells, grown *in vitro* and showing cytopathogenic changes following passage of polyoma virus preparations, spherical particles of 270 Å in diameter and of low electron density were observed. Similar particles were also found in parotid gland neoplasms and mammary tumors induced in NIH (Swiss) mice by polyoma-infected tissue-culture fluids. ***Leon Dmochowski, Clifford E. Grey, and Lyman A. Magee.*** *Society for Experimental Biology and Medicine, Proceedings,* v. 102, no. 3, Dec. 1959, p. 575-579.

3867* Establishment of Resistance to Growth of Ehrlich Ascites Carcinoma in C57 Black Mice. It has been possible to immunize C57BL mice against Ehrlich carcinoma by giving 5 to 10 injections of Ehrlich carcinoma X-irradiated with 2000 to 4000 r. Of 70 mice so immunized, 66 survived the first challenge with viable cells; and all 35 of the mice receiving 8 challenges survived. ***Ralph W. McKee, Eugene Garcia, M. Richard Troeh, and Charles Slater.*** *Society for Experimental Biology and Medicine, Proceedings,* v. 102, no. 3, Dec. 1959, p. 591-593.

3868* Carcinogenic Effect of Hens' Eggs as Part of the Diet in Mice. ***J. Szepsenwol.*** *Society for Experimental Biology and Medicine, Proceedings,* v. 102, no. 3, Dec. 1959, p. 748-751.

3869 Symposium on Nuclear Sex. A collection of papers in many fields with interests related to nuclear sexing including anatomy, biochemistry, biology, clinical medicine, cytology, endocrinology, genetics, pathology, physiology, psychology, and surgery. ***D. Robertson Smith, William M. Davidson, and Robert Platt.*** 188 pp. 1958. Interscience Publishers, New York. (QH595 Sy68s)

3870 Problems of Infection, Immunity and Allergy in Acute Radiation Sickness. ***N. N. Klemparskaya, O. G. Alekseyeva, R. V. Petrov, and V. F. Sosova.*** *U. S. Atomic Energy Commission, AEC-tr-*3767, 133 pp. (UF767 Un3.1ae Contin.)

3871* Genetic Factors in Parabiosis. Parabiotic compatibility is primarily dependent on identical alleles at the *H*-2 locus. "Bilateral" difference at the *H*-2 locus—each partner having an *H*-2 allele not carried by the other—results in separation of partners during or after the second week of union. "Unilateral" difference at the *H*-2 locus, one partner having an *H*-2 allele not carried by the other, as in many "pure" F_1 hybrid unions, usually results in "parabiotic intoxication" of the partner carrying the foreign allele. Death commonly occurs during the latter half of the second week or the first half of the third week. ***E. J. Eichwald, E. C. Lustgraaf, and M. Strainer.*** *U. S. National Cancer Institute, Journal,* v. 23, no. 6, Dec. 1959, p. 1193-1207 + 3 plates.

3872* Genetic Determination of Sex-Specific Antigens. In *Drosophila,* two male-specific antigens and two female-specific antigens are demonstrated by means of agar-diffusion techniques. These differences between males and females are attributable to the difference in number of X chromosomes (one in males and two in females) rather than to the presence or absence of the Y chromosome, thus suggesting involvement of the sex-determining genes carried by the X. ***Allen S. Fox.*** *U. S. National Cancer Institute, Journal,* v. 23, no. 6, Dec. 1959, p. 1297-1308 + 1 plate.

3873* Effect of Bone Marrow Culture *in Vitro* on Its Protective Action in Irradiated Mice. After four days of culture, a decreased protective activity of injected tissue-cultured cells was observed. By the ninth day of life *in vitro,* the explanted bone marrow cells had essentially lost their protective capacity. Analysis of the cell species present at this time showed that several stem-cell types persisted in such negative cultures. ***Daniel Billen.*** *U. S. National Cancer Institute, Journal,* v. 23, no. 6, Dec. 1959, p. 1389-1394 + 1 plate.

3874* Oncogenic Effect of Tissue-Culture Preparations of Polyoma Virus on Fetal Mice. Swiss mice inoculated late in fetal life with tissue-culture preparations of SE polyoma virus died earlier, and had a higher incidence of tumors than animals inoculated shortly after birth. ***Mearl F. Stanton, Sarah E. Stewart, Bernice E. Eddy, and Robert H. Blackwell.*** *U. S. National Cancer Institute, Journal,* v. 23, no. 6, Dec. 1959, p. 1441-1460 + 7 plates.

3875* Suppressive Effects of Pyrilamine Maleate and d-Lysergic Acid Diethylamide (LSD-25) on Early Corneal Lesions Produced *in vitro* by Newcastle Disease Virus (NDV) and Compound 48/80. ***Jang O. Oh and Charles A. Evans.*** *Virology,* v. 10, no. 1, Jan. 1960, p. 127-143.

3876 Vitamins and Hormones, Advances in Research and Applications. Metabolism of folic acid and other pterin-pteridine vitamins, chemistry and biochemistry of the K vitamins, hepatic glucose-6-phosphatase, serotonin and other indoleamines, ergothioneine, mechanisms of action of estrogens, and progestational agents and the control of fertility. ***Robert S. Harris, G. F. Marrian, and Kenneth V. Thimann, editors.*** v. XVII. 359 pp. 1959. Academic Press, New York. (QP801.V5 V83 Vis.)

See also: **3795** (virus inhibition by plant juices); **3796** (chemical inhibition of virus multiplication); **4010** (carbohydrate chemistry).

CERAMICS AND CONCRETE

3877 Tapered Roller Bearings in Kiln Car Design. Dead axle design utilizing high quality antifriction tapered roller bearings provides the best service and is, over the years, the most economical. Advantages of this type design are discussed as well as the limitations it places on the design of the kiln itself and on the lubricants used. ***R. E. Martinsen.*** *American Ceramic Society Bulletin,* v. 39, Jan. 1960, p. 7-9.

3878 Development of a Synthetic Mica Ceramic Suitable for Use at 750°C. A process is described in which synthetic mica is precipitated during firing as the primary crystalline phase in a lead glass binder resulting in a ceramoplastic of unusual properties. The material can be machined by ordinary shop tools using techniques analogous to standard glass-bonded mica fabrication. This factor plus low dielectric loss, and a thermal coefficient of expansion matching stainless steel has resulted in successful preparation of sealed terminals and headers, fired-on printed circuits and other special electronic insulation components. ***Philip S. Hessinger and Thomas W. Weber.*** *American Ceramic Society Bulletin*, v. 39, Jan. 1960, p. 10-13.

3879 Failure Mechanisms of Solid Propellant Rocket Nozzles. Twenty-five refractory materials were evaluated as nozzle inserts in rocket motors using high-energy solid propellants. The motors, operated at various combinations of chamber pressure and burning time, yielded exhaust temperatures of about 4750 F. Although the degree of nozzle erosion varied considerably, all materials were attacked. Failure mechanisms, presented for the better-performing materials, were determined using chemical, microscopic, and X-ray diffraction analysis. ***Y. Baskin, T. A. Greening, and M. J. Kemp.*** *American Ceramic Society Bulletin*, v. 39, Jan. 1960, p. 14-17.

3880* Artificial Carbonation of Concrete Masonry Units. Slow carbonation by CO_2 in the air and its attendant shrinkage may be a contributing factor to masonry wall cracking. A process of hastening carbonation of masonry units might be developed which would "preshrink" them, thus eliminating atmospheric carbonation and attendant shrinkage after the units were in a wall. Describes a project to develop such a process of artificial carbonation. ***Henry T. Toennies.*** *American Concrete Institute, Journal*, v. 31; *ACI Proceedings*, v. 56, no. 8, Feb. 1960, p. 737-755.

3881* Shrinkage and Creep of Concrete. Reports on tests of the four major factors that contribute to shrinkage and creep. Equations are derived, based on the data obtained from the tests, for determining the combined shortening effects of creep and shrinkage. ***Inge Lyse.*** *American Concrete Institute, Journal*, v. 31; *ACI Proceedings*, v. 56, no. 8, Feb. 1960, p. 775-782.

3882 Chemical and Spectrochemical Analyses of Illinois Clay Materials. Brings together published and unpublished chemical and spectrochemical analyses that are available for Illinois clay materials. Deposits analyzed include both active and abandoned pits and mines, as well as some deposits that never have been worked and for which no chemical and mineralogical data have been available. ***W. Arthur White.*** *Illinois State Geological Survey, Circular* 282, 1959, 55 pp. (TN21 IL6.7c Vis.)

3883 Theoretical Model for Tetragonal-to-Cubic Phase Transformations in Transition Metal Spinels. Investigates the detailed properties of the transformations from tetragonal to cubic phases which are observed at elevated temperatures. An approximate model is constructed which explicitly takes into account the interactions between local Jahn-Teller distortions about neighboring octahedral site cations. The configurational energy of the model is derived in a completely general form in terms of occupation variables, and is used to deduce the structure of the stable low-temperature phase. ***Peter J. Wojtowicz.*** *Physical Review*, v. 116, 2nd ser., no. 1, Oct. 1, 1959, p. 32-45.

3884* Test on the Influence of the Properties of Cement on the Creep of Mortar. Mortar specimens made with fifteen Portland cements of known properties were subjected to a constant compressive stress. It was found that creep is approximately proportional to the "stress-strength ratio"—a quantity introduced by the author. Properties of cement other than strength were found to have no significant influence on creep. ***A. M. Neville.*** *R.I.L.E.M. International Association of Testing and Research Laboratories for Materials and Structures, Bulletin No.* 4, 1959, p. 5-17.

3885* A New Method to Study the Early Volume Changes on the Neat Cement Paste. Presents a method for the study of the variations in volume of pure cement paste, immediately after depositing, during setting and initial hardening. Gives results obtained by means of a dilatometer that avoids the effects of evaporation, humidity, and temperature changes. ***M. del Campo.*** *R.I.L.E.M. International Association of Testing and Research Laboratories for Materials and Structures, Bulletin No.* 4, 1959, p. 18-23.

3886* A Study of the Grout for Prestressed Concrete Structures. Tests showed that ordinary neat cement grout would crack, and also cause the surrounding concrete to crack when subjected to freezing temperatures immediately after grouting. The addition of air entraining agents did not essentially change the behavior when frozen immediately, but after a few days of curing an air entrainment of 8 to 12% would remove the danger of cracking. The air entrainment also reduced the tendency of bleeding of the grout. Introduction of special plasticizers practically eliminated bleeding. ***I. Lyse and R. Johansen.*** *R.I.L.E.M. International Association of Testing and Research Laboratories for Materials and Structures, Bulletin No.* 4, 1959, p. 59-65.

3887 An Electron Microscope Study of Synthetic Graphite. The ultramicrotome was used to obtain thin sections of synthetic graphite blocks. The thickness of the sections was measured by shadowcasting and measuring the shadow length at appropriate edges. An average value of 150 Å was obtained. It was found that the hexagonal layer net planes were lying parallel or at a very small angle to the plane of the section. The moiré patterns in the electron micrographs could be related to the long spacings in the electron diffraction patterns. ***I. M. Dawson and E. A. C. Follett.*** *Royal Society, Proceedings*, v. 253, ser. A, Dec. 15, 1959, p. 390-402.

3888 Fabrication of Infrared Transmitting Materials by Hot Pressing Techniques. BaF_2 compacts with good transparency in the visible and infrared were produced under pressures of 20,000 to 60,000 psi at temperatures below 900 C. The hot pressing of polycrystalline MgF_2 was studied over a pressure range of 20,000 to 60,000 psi and at temperatures up to 900 C. Compacts with excellent transmission have been fabricated. SF_2 and CaF_2 were successfully fabricated into compacts with excellent infrared transmissions. LiF_2, LaF_3, and K_2ZrF_6 were also hot pressed. Fe_2O_3, MgO, ZnO, Co_3O_4, Cu_2O and $CoO \cdot Al_2O_3$ were studied, and in addition PbS and CdS were hot pressed. ***Norbert J. Kreidl, et al.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-275, Oct. 1959, 113 pp. (TL507 Un3.18w Vis.)

3889 Ceramic Studies Summary Technical Report. Progress is reviewed in the preparation of high-purity and doped-sintered alumina samples. Describes a high-precision fast-recording, bending creep furnace with resolution of at least 10^{-6} strain in the outer fiber. Progress in an electrical study of corundum-metal interface is reviewed. Migration of Ag ions from a coating is found above 200 C on application of several volts/cm. ***P. Gibbs, G. S. Baker, E. K. Beauchamp, and M. H. Miles.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-381, Aug. 1959, 13 pp. (TL507 Un3.18w Vis.)

3890 Swaged Metal Fiber-UO_2 Fuel Element. First Quarterly Progress Report, December 22, 1958 to March 15, 1959. Second Quarterly Progress Report, March 15, 1959 to June 15, 1959. Third Quarterly Progress Report, June 15, 1959 to September 15, 1959. A minimum blending time of 3 hr is required for 5 vol% fiber-UO_2 blends, while 4 hr seems to be the minimum for 10 vol% fiber-UO_2 blends. All samples swaged in this experiment exhibited a nonuniform fiber distribution, presumably due to segregation of powder and fiber during sample packing. The feasibility of producing UO_2-Mo fiber cores by impregnating fibers with a UO_2 slurry was investigated. The best fiber distribution was obtained with a slip casting and ramming technique. This method was modified by pressing mixtures of UO_2 and fiber in tubes. At the pressures used for preswage compacting, no particle crushing can take place. As the swaging causes orientation of fibers in an axial direction, an effort is being made to decrease the amount of swaging required. First and Second Quarterly Progress Report, ***Lennart Sundquist***; Third Quarterly Progress Report, ***John Kane.*** *U. S. Atomic Energy Commission, MND*-SF-1714, 1768, 1769, Apr., July, and Oct. 1959, 30, 48, and 37 pp. (UF767 Un3.1mn Contin.)

3891 Pilot Plant Preparation of Thorium- and Thorium-Uranium Oxides. The ThO_2 is formed by the calcination of thorium oxalate precipitated under carefully controlled conditions. Material is produced with mean particle diameters of 1-5μ. Some of the ThO_2 has had U added to it by decomposing uranyl carbonate on the ThO_2 followed by calcination. Most of the oxides prepared were calcined to 1000 C or more. ***K. O. Johnsson and R. H. Winget.*** *U. S. Atomic Energy Commission, ORNL-2853,* Dec. 22, 1959, 17 pp. (UF767 U3o Contin.)

See also: **4516** (use of basic brick in open hearth furnace roof).

CHEMICAL ENGINEERING

3892 Evaporation Rates of Liquids to Flowing Gas Streams. ***D. E. Severson, A. J. Madden, and Edgar L. Piret.*** *A.I.Ch.E. Journal,* v. 5, no. 4, Dec. 1959, p. 413-418.

3893 Solid-Catalyzed Reaction in a Fluidized Bed. Effect of gas velocity, bed height, catalyst activity, particle size, and internal baffles on fluidized reactor efficiency are given. ***W. K. Lewis, E. R. Gilliland, and Werner Glass.*** *A.I.Ch.E. Journal,* v. 5, no. 4, Dec. 1959, p. 419-426.

3894 Performance of a Reciprocating-Plate Extraction Column. ***Andrew E. Karr.*** *A.I.Ch.E. Journal,* v. 5, no. 4, Dec. 1959, p. 446-452.

3895 Kinetics of the Hydrogenation of Ethylene (on a Nickel Catalyst). ***A. C. Pauls, E. W. Comings, and J. M. Smith.*** *A.I.Ch.E. Journal,* v. 5, no. 4, Dec. 1959, p. 453-457.

3896 The Economic Design of Mixer-Settler Extractors. ***Robert E. Treybal.*** *A.I.Ch.E. Journal,* v. 5, no. 4, Dec. 1959, p. 474-482.

3897 The Vapor-Phase Catalytic Hydration of Ethylene Oxide to Glycols. Particles of polystyrene-sulfonic acid ion exchange resins are used as catalysts. ***A. B. Metzner and J. E. Ehrreich.*** *A.I.Ch.E. Journal,* v. 5, no. 4, Dec. 1959, p. 496-501.

3898 Studies on Entrainment. Size distribution of liquid drops from air bubbles blown through water and a butanol and glycerine solution filled to a certain depth in a glass cylinder 9.6 cm in diameter and 47 cm in length was measured. Initial vertical velocity of drops was estimated from the experimental results, with reference to its trajectory. ***Shuichi Aiba and Toyokazu Yamada.*** *A.I.Ch.E. Journal,* v. 5, no. 4, Dec. 1959, p. 506-509.

3899 Interfacial Resistance Due to Thin Films of Alcohols and Its Effect on the Rate of Evaporation of Water. ***Lalit H. Udani and Kenneth F. Gordon.*** *A.I.Ch.E. Journal,* v. 5, no. 4, Dec. 1959, p. 510-513.

3900 The Mechanics of Vertical Moving Liquid-Liquid Fluidized Systems. I. Interphase Contacting of Droplets Passing Through Second Quiescent Fluid. ***Robert E. C. Weaver, Leon Lapidus, and J. C. Elgin.*** *A.I.Ch.E. Journal,* v. 5, no. 4, Dec. 1959, p. 533-539.

3901* Sulfuration in Pyrite. Shows that the disruption of the bond between the sulfide layer and the base is in general caused by: poor degreasing of the metal subjected to sulfuration; different coefficients of heat expansion of Fe and the formed sulfide layer; phase transitions in the sulfide layer during cooling; formation of a sooty sublayer on the border between the sample and the layer; the considerable role of the diffusion of Fe in the process of growth of the sulfide layer, which results first in a high porosity of a part of the layer and later in a slit between the base and the layer; and the harmful effect of O. (*In Russian.*) Sul'fidirovanie v pirite. ***K. V. Gorev and S. L. Livshitz.*** *Akademiia Navuk Belaruskaia SSR, Doklady,* v. 3, no. 12, Dec. 1959, p. 496-499.

3902* Preparation of Pure Fatty Acid Methyl Esters by Countercurrent Distribution. ***C. R. Scholfield, Janina Nowakowska, and H. J. Dutton.*** *American Oil Chemists' Society, Journal,* v. 37, Jan. 1960, p. 27-30.

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See also: **4100** (aerosol coatings developments); **4223** (aerosol products development); **4227** (review of chemical industry 1959-1960); **4254** (heat transfer to moving fluids); **4265** (boiling of liquids); **4303** (producing equipment for natural gas); **4879** (pressure vessel seams).

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3983 Determination of Chemically Combined Iodine in Sea Water by Amperometric and Catalytic Methods. ***Richard A. Barkley and Thomas G. Thompson.*** *Analytical Chemistry*, v. 32, Feb. 1960, p. 154-158.

3984 Direct Amino Acid Analysis by Gas Chromatography. Amino acids are oxidized to aldehydes in a microreactor. The aldehydes are chromatographically separated, catalytically cracked, and analyzed in a thermal conductivity cell. ***Albert Zlatkis, John F. Oró, and A. P. Kimball.*** *Analytical Chemistry*, v. 32, Feb. 1960, p. 162-164.

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3990* The Determination of Zinc Oxide in Rubber Vulcanizates by X-Ray Diffraction. Method for the direct determination of ZnO in rubber vulcanizates. Technique employed is rapid and nondestructive and has a relative error less than ±10% of the amount of ZnO present. ***Stephen H. Laning, Melvin P. Wagner, and John W. Sellers.*** *Journal of Applied Polymer Science*, v. 2, no. 5, Sept.-Oct. 1959, p. 225-230.

3991 Gas Chromatographic Separation of Longchain Fatty Acid Methyl Esters on Polyvinyl Acetate. Use of commercially available polyvinyl acetates to separate completely the methyl esters of stearic, oleic, linoleic, and linolenic acids. ***Irwin Hornstein, L. E. Elliott, and P. F. Crowe.*** *Nature*, (Suppl. No. 22), v. 184, Nov. 28, 1959, p. 1710-1711.

3992 Benzene- and Naphthalene Seleninic Acid Ammonia as Reagents for the Quantitative Determination of Titanium. Two reagents $C_6H_5SeO_2NH_4$ and $C_{10}H_7SeO_2NH_4$ are suggested for the determination of Ti and its separation from other elements (Al, Be, rare earth elements, and Fe). The composition of the precipitate corresponds approximately to the formulas $TiO(C_6H_5SeO_2)_2$ and $TiO(C_{10}H_7SeO_2)_2$. For the quantitative determination, the precipitates are annealed and Ti is determined as TiO_2. *(In Russian.)* Benzol- i naftalinseleninovokislyy ammoniy kak reagenty dlya kolichestvennogo opredeleniya titana. ***V. S. Sotnikov and I. P. Alimarin.*** *Nauchnye Doklady Vysshei Shkoly, Khimiia i Khimicheskaia Tekhnologiia*, 1959, no. 2, p. 296-298.

3993* The Determination of Iron and Manganese by Atomic Absorption. Most sensitive lines in absorption are Fe 2483·3Å and Mn 2794·8 Å; when these lines are used, the atomic absorption method gives accurate results simply and reproducibly and can with advantage be employed for determination of the two elements. ***J. E. Allan.*** *Spectrochimica Acta*, 1959, no. 10, Nov. 1959, p. 800-806 + 1 plate.

3994* Location of a Branch in a Saturated Carbon Chain. Oxidative degradation by chromic acid in glacial acetic acid developed as an effective method for location of a branch in a saturated C chain. Mechanism of the oxidation and the protective influence of carboxyl are discussed. ***J. Cason, J. Searing Fessenden, and C. L. Agre.*** *Tetrahedron*, v. 7, nos. 3-4, Nov. 1959, p. 289-298.

3995 Determination of Metallic Impurities in Uranyl Nitrate Solutions by X-Ray Fluorescence. An X-ray fluorescence spectrometer was used to measure the concentration of Fe in uranyl nitrate solutions. An estimate of the U concentration was obtained simultaneously. The sensitivity of the fluorescence method for 11 other elements was obtained. ***Richard E. Sladky.*** *U. S. Atomic Energy Commission*, Y-1276, Mar. 2, 1959, 25 pp. (UF767 Un3.1y Contin.)

See also: **3882** (analysis of clays); **4435** (analytical instrumentation); **4532** (analysis of slag).

CHEMISTRY—INORGANIC AND GENERAL

3996 The Thermal Stabilities and Infrared Spectra of Some Solid Metal Salt Stabilized Diazonium Salts. Chlorides of Fe(III), Zn(II), Cd(II), Sn(IV), Sb(III), Hg(II) and Bi(III) were used to stabilize *p*-dimethylaminobenzenediazonium chloride. The rates of N_2 evolution from the solids at elevated temperatures and infrared spectra of the solids were recorded. ***Alcuin F. Gremillion, Hans B. Jonassen, and Robert J. O'Connor.*** *American Chemical Society, Journal*, v. 81, Dec. 5, 1959, p. 6134-6138.

3997 Reactions Between Dry Inorganic Salts. X. The Effect of Rubidium Chloride on the Transition Temperature of Cesium Chloride. The effect of RbCl on the transition temperature of CsCl was studied by means of the high temperature X-ray camera. Increasing amounts of added RbCl cause a spectacular lowering of the transition temperature; at room temperature, up to 30 mole % of the high temperature form of CsCl may remain in the RbCl in the form of a solid solution. ***Lyman J. Wood, Chas. Sweeney, and M. Therese Derbes.*** *American Chemical Society, Journal*, v. 81, Dec. 5, 1959, p. 6148-6152.

3998 Composition and Stability of 5-Sulfosalicylate Complexes of Beryllium and Copper. Spectrophotometric studies of the beryllium-5-sulfosalicylate system indicate the presence of two complexes: one predominating at *p*H 5.2 and another predominating at *p*H 8.0. ***Charles V. Banks and Rajendra S. Singh.*** *American Chemical Society, Journal*, v. 81, Dec. 5, 1959, p. 6159-6163.

3999 Preparation, Properties and Reactions of Bismuth Pentafluoride. Preparation by synthesis from Bi and F at 500 C. Crystal structure, density of the solid and liquid, triple point temperature, and vapor pressure were determined and the latent heat of vaporization and Trouton constant were calculated. ***Jack Fischer and Edgars Rudzitis.*** *American Chemical Society, Journal*, v. 81, Dec. 20, 1959, p. 6375-6377.

4000 Difluorodiazine. Obtained from the electrolysis of ammonium bifluoride, N_2F_2 exists as a mixture of *cis* and *trans* isomers which have been separated. Vapor pressure, infrared, mass spectrometric, and n.m.r. data are given for each isomer. ***Charles B. Colburn, et al.*** *American Chemical Society, Journal*, v. 81, Dec. 20, 1959, p. 6397-6398.

4001* On the Structural Relationship of Vitreous Potassium Pentaborate to the Crystalline Modifications. The density and unit cell of α-potassium pentaborate were measured. ***J. Krogh-Moe.*** *Arkiv för Kemi*, v. 14, no. 6, 1959, p. 567-572.

4002 Inorganic Polymerization Reactions. I. Condensation Polymerization. Cationic and anionic aggregation in solution; desolvation processes at higher temperatures; solvolytic reactions; reactions involving polyfunctional inorganic and organic molecules. ***D. B. Sowerby and L. F. Audrieth.*** *Journal of Chemical Education*, v. 37, Jan. 1960, p. 2-10.

4003 Modern Aspects of Inorganic Chemistry. Atomic structure, periodic system, atomic weights, isotopes, valency, constitution of solid inorganic compounds, structure of molecules of inorganic compounds, co-ordination compounds and inorganic stereochemistry, polyacids and silicates, hydrogen, hydrides, free radicals of short life, non-metallic oxides and related compounds, recent chemistry of the non-metals, peroxides and per-acids, metallic carbonyls, nitrosyls and related compounds, metals and intermetallic compounds, interstitial and non-stoichiometric compounds, reactions in liquid ammonia and other non-aqueous media, and radioactivity and atomic disintegration. ***H. J. Emeléus and J. S. Anderson.*** 2nd Rev. Ed. 557 pp. 1956. D. Van Nostrand Co. New York. (QD151 Em31m2)

4004* Preparation and Some Properties of $ISbCl_6$ and $IAlCl_6$. Preparation of $ISbCl_6$ (m.p. 83.5 C, d = 3.00 ± 0.02) and $IAlCl_6$ (m.p. 105 C, d = 2.64 ± 0.02). The compounds react readily with water and decompose on heating. ***C. G. Vonk and E. H. Wiebenga.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 78, Nov. 1959, p. 913-920.

4005* The Preparation of Pure Silicon. Apparatus is described for the preparation of pure Si by thermal decomposition of trichlorosilane on a hot Ta wire in a H_2 atmosphere. The polycrystalline Si is obtained in the form of rods with a diameter of about 15 mm and a length of 20-40 cm. ***P. C. van der Linden and J. de Jonge.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 78, Nov. 1959, p. 962-966.

4006 Reports on the Progress of Applied Chemistry. A series of reports on applied chemistry as related to the following: fuel and fuel products; organic and inorganic chemistry; metals; biological products; textiles, plastics, paints; chemical engineering and hazards; agriculture and food. v. XLIII. 911 pp. 1958. Society of Chemical Industry, London. (TP1 So13r Vis.)

4007* Infrared Spectra of Inorganic Phosphorus Compounds. The infrared spectra of 55 inorganic P compounds including orthophosphates, phosphorofluoridates, pyrophosphates, imidodiphosphates, and metaphosphimates. ***J. V. Pustinger, Jr., W. T. Cave, and M. L. Nielsen.*** *Spectrochimica Acta*, 1959, no. 11, Dec., p. 909-925.

See also: **4443** (binary nitrogen compounds).

CHEMISTRY—ORGANIC

4008* Amino Acid Studies. II. Structure and Synthesis of Albizziine (L-2-Amino-3-ureidopropionic Acid), an Amino Acid From Higher Plants. The suggested structure, L-2-amino-3-ureidopropionic acid, was established by comparison of N-benzoylalbizziine methyl ester with a synthetic specimen of methyl L-2-benzamido-3-ureidopropionate. ***Anders Kjaer and P. Olesen Larsen.*** *Acta Chemica Scandinavica,* v. 13, no. 3, 1959, p. 1565-1574.

4009* Studies on Local Anesthetics. XVIII. Synthesis of N-(Dialkylaminoalkyl)benzamides. ***Björn Lüning.*** *Acta Chemica Scandinavica,* v. 13, no. 3, 1959, p. 1623-1633.

4010 Advances in Carbohydrate Chemistry. Action of lead tetraacetate on the sugars; Maillard reaction; cyclitols; chemistry of the amino sugars; pyrimidine nucleosides; preparation and properties of β-glucuronidase; and structural chemistry of the hemicelluloses. ***Melville L. Wolfrom, editor.*** v. XIV. 525 pp. 1959. Academic Press, New York. (QD321 A93 Vis.)

4011 Alkoxyphenyl N-Substituted Aminopropanols. Several 1-alkoxyphenyl 3-N-substituted aminopropanols-2 were prepared. They were screened on laboratory animals for anesthetic potency, toxicity and for irritation. The anesthetic efficiencies of some of these compounds were sufficiently high to warrant clinical study. ***Elias Epstein.*** *American Chemical Society, Journal,* v. 81, Dec. 5, 1959, p. 6207-6209.

4012 Non-enzymatic Conversions of Dopamine to Norepinephrine and Trihydroxyphenethylamines. *Intra*molecular acylation of the quinones of (acyl)-aminocatechols under the conditions of the Thiele reaction, or with boron trifluoride etherate, leads, *via* benzoxazole derivatives, to substituted trihydroxyanilines. ***Siro Senoh and Bernhard Witkop.*** *American Chemical Society, Journal,* v. 81, Dec. 5, 1959, p. 6222-6231.

4013 Synthesis of Alkylsilylphosphines. Alkylsilylphosphines synthesized by reaction of alkylchlorosilanes with Li derivatives of phosphine and substituted phosphines. Cyclic derivatives were obtained from dilithium phosphides and diethyldichlorosilane. ***G. W. Parshall and R. V. Lindsey, Jr.*** *American Chemical Society, Journal,* v. 81, Dec. 5, 1959, p. 6273-6275.

4014 Phosphorus Derivatives of Fatty Acids. VII. Addition of Dialkyl Phosphonates to Unsaturated Compounds. Addition of dialkyl phosphonates to unsaturated compounds under free radical conditions shown to be a general reaction of wide applicability. Addition proceeds smoothly with unsaturated compounds containing a terminal or an isolated double bond and also with a series of vinyl esters. ***Richard Sasin, William F. Olszewski, John R. Russell, and Daniel Swern.*** *American Chemical Society, Journal,* v. 81, Dec. 5, 1959, p. 6275-6277.

4015 Substituted 1,10-Phenanthrolines. XI. Aza Derivatives. Syntheses of 2-, 3-, 4-, and 5-aza-1,10-phenanthrolines and of 4,7-diaza-1,10-phenanthroline compounds are expected to form chelates with Fe(II) and possibly Cu(I). ***Francis H. Case and James A. Brennan.*** *American Chemical Society, Journal,* v. 81, Dec. 5, 1959, p. 6297-6301.

4016 Acid-Catalyzed Cleavage of π-Substituted Tricyclenes. Synthesis of 3,8-Cyclocamphor. Syntheses of several *cis*-π-substituted camphor derivatives are described including *cis*-π-bromocamphor, *cis*-π-cyanocamphor, *cis*-isoketopinic acid and 3,8-cyclocamphor. ***E. J. Corey, Masaji Ohno, S. W. Chow, and Robert A. Scherrer.*** *American Chemical Society, Journal,* v. 81, Dec. 5, 1959, p. 6305-6309.

4017 The Oxidation of Hydrocarbons. III. The Decomposition of Acetyl Peroxide in Cyclohexene Solutions. Thermal decomposition of acetyl peroxide in cyclohexene solution at 80 C and at reflux temperature. ***H. J. Shine and J. R. Slagle.*** *American Chemical Society, Journal,* v. 81, Dec. 5, 1959, p. 6309-6313.

4018 Liquid Phase Nitration of Bicyclo[2.2.1]heptane and Decahydronaphthalene. ***George W. Smith.*** *American Chemical Society, Journal,* v. 81, Dec. 5, 1959, p. 6319-6322.

4019 Organoboranes. I. Isomerization and Displacement Reactions of Organoboranes. A Convenient Procedure for the Conversion of Internal Olefins Into Primary Alcohols. Hydroboration of 2-hexene yields an organoborane which, oxidized directly without prior isolation, yields 2- and 3-hexanol in equimolar amounts. If the organoborane is heated in refluxing diglyme (160 C) for four hours prior to oxidation, the product obtained is essentially pure 1-hexanol. ***Herbert C. Brown and B. C. Subba Rao.*** *American Chemical Society, Journal,* v. 81, Dec. 20, 1959, p. 6434-6437.

4020 Reactions of 2,5-Cyclohexadienones Containing the Trichloromethyl Group. ***Melvin S. Newman and Louis L. Wood, Jr.*** *American Chemical Society, Journal,* v. 81, Dec. 20, 1959, p. 6450-6454.

4021 Rearrangement of 4-Methyl-4-trichloromethyl-2,5-cyclohexadienols. ***Melvin S. Newman, John Eberwein, and Louis L. Wood, Jr.*** *American Chemical Society, Journal,* v. 81, Dec. 20, 1959, p. 6454-6456.

4022 Condensed Cyclobutane Aromatic Compounds. VIII. The Mechanism of Formation of 1,2-Dibromobenzocyclobutene; a New Diels-Alder Synthesis. ***M. P. Cava, A. A. Deana, and K. Muth.*** *American Chemical Society, Journal,* v. 81, Dec. 20, 1959, p. 6458-6460.

4023 N-Substituted Oxazolidinediones. A series of oxazolidine diones was synthesized and examined for anticonvulsant activity, ultraviolet absorption characteristics, and behavior upon alkaline hydrolysis. ***Seymour L. Shapiro, et al.*** *American Chemical Society, Journal,* v. 81, Dec. 20, 1959, p. 6498-6504.

4024 The Aromatic Reactivity of Ferrocene, Ruthenocene and Osmocene. The metallocenes are compared to one another and to the aromatic system. Reactions, acid dissociations constants, and infrared data for these substances are given. ***Marvin D. Rausch, Ernst O. Fischer, and Heinrich Grubert.*** *American Chemical Society, Journal,* v. 82, Jan. 5, 1960, p. 76-82.

4025 Preparation of N-Trisubstituted Borazines by Reduction of B-Trichloroborazines. Experimental analysis and properties results are given for the N-substituted boranes. Several new borazines are reported. ***Leo F. Hohnstedt and Daniel T. Haworth.*** *American Chemical Society, Journal,* v. 82, Jan. 5, 1960, p. 89-92.

4026 A Stereochemical Study of the Cleavage of Organomercurials by Various Brominating Agents. Data reported on the cleavage of *cis*- and *trans*-4-methylcyclohexylmercuric bromides by Br in a variety of solvents and by various brominating agents. ***Frederick R. Jenson and Laird H. Gale.*** *American Chemical Society, Journal,* v. 82, Jan. 5, 1960, p. 148-151.

4027 Bismethylenedioxy Steroids. III. The Synthesis of 7α- and 7β-Methylhydrocortisones. IV. 11α-Methylhydrocortisone Acetate and 9α-Chloro-11α-methylhydrocortisone Acetate. Catalytic reduction of a 5,7(7′)-diene with an 11α-oxygenated substituent leads to the 7α-methyl series, whereas catalytic reduction of a 7-methyl-4,6-diene-3-one with an 11β-oxygenated substituent leads to the 7β-methyl series. 11α-Methylhydrocortisone acetate was prepared from cortisone-BMD by a five-step synthesis; 9α-chloro-11α-methylhydrocortisone acetate was prepared from an eight-step syntheses starting with 9α-fluorohydrocortisone-BMD. III. ***R. E. Beyler, A. E. Oberster, Frances Hoffman, and L. H. Sarett.*** IV. ***R. E. Beyler, Frances Hoffman, and L. H. Sarett.*** *American Chemical Society, Journal,* v. 82, Jan. 5, 1960, p. 170-182.

4028 Quinoxalines. I. Preparation and Stereochemistry of Decahydroquinoxalines. First authentic synthesis of *cis*-decahydroquinoxaline was obtained in high yield by the hydrogenation of quinoxaline or tetrahydroquinoxaline over 5% rhodium-on-alumina catalyst at 100 and 136 atm. or over freshly prepared Raney NiW-6 under similar conditions. ***H. Smith Broadbent, Evan L. Allred, Lynn Pendleton, and Charles W. Whittle.*** *American Chemical Society, Journal,* v. 82, Jan. 5, 1960, p. 189-193.

4029 The Synthesis and Properties of γ-Aminoacetoacetic Acid. The preparation of γ-aminoacetoacetic acid from acetonedicarboxylic acid via γ-oximinoacetoacetic acid. Acidity and

crystalline structures are discussed. ***J. N. Neilands, A. Neuberger, and J. J. Scott.*** *American Chemical Society, Journal*, v. 82, Jan. 5, 1960, p. 214-217.

4030* Mass Spectrometric Studies. II. Saturated Normal Long-Chain Esters of Ethanol and Higher Alcohols. III. Esters of Saturated Dibasic Acids. Compounds studied included five esters of *n*-docosanol and ethyl and *n*-butyl *n*-octadecanoate. ***Ragnar Ryhage and Einar Stenhagen.*** *Arkiv för Kemi*, v. 14, no. 6, 1959, p. 483-509.

4031* Oxidation of 1-Methylnaphthalene With Chromic Acid in Acetic Acid. 1-Methyl-1,2-naphthaquinol, 2-acetobenzoic acid, 3-methylenephthalide, 1-naphthoic acid, phthalic acid, and 5-methyl-1,4-naphthaquinone were isolated and identified from the reaction mixture formed when 1-methylnaphthalene is oxidized with chromic acid. ***Gerd Bendz and Arne Thalén.*** *Arkiv för Kemi*, v. 14, no. 6, 1959, p. 519-526.

4032* The Stereoisomeric Forms of Tetrahydroselenapyrane-2,6-dicarboxylic Acid. ***Arne Fredga and Karin Styrman.*** *Arkiv för Kemi*, v. 14, no. 41, 1959, p. 461-465.

4033* A New Synthesis of 5-Bromo- and 5-Hydroxylaevulic Acid. Preparation in good yields according to a new synthesis. Structure of methyl 5-bromo-laevulate and 5-hydroxylaevulic acid are confirmed by their NMR-spectra. ***Christoffer Rappe.*** *Arkiv för Kemi*, v. 14, no. 41, 1959, p. 467-473.

4034* Cyclialkylations of Alkyl Benzenes With Olefins and Alkyl Halides. Formation of octamethyloctahydroanthracene from 1,3,5-tri-*t*-butylbenzene and *t*-butyl chloride. ***L. Ross, C. Barclay, J. W. Hilchie, A. H. Gray, and N. D. Hall.*** *Canadian Journal of Chemistry*, v. 38, Jan. 1960, p. 94-103.

4035* The Structure of 2-*p*-Dimethylaminobenzylideneindoxyl and Its Salts. The dipolar quinonoid structure was established by a study of infrared and ultraviolet absorption spectra and by a comparison of these with those of the monohydrochloride, methiodide, and of 2-benzylideneindoxyl. ***R. A. Abramovitch and A. M. Marko.*** *Canadian Journal of Chemistry*, v. 38, Jan. 1960, p. 131-135.

4036* Total Synthesis of Isorenieratene. Confirmation of the structure of isorenieratene by a syntheses study. ***Masaru Yamaguchi.*** *Chemical Society of Japan, Bulletin*, v. 32, no. 11, Nov. 1959, p. 1171-1173.

4037* The Preparation and Properties of N-Salicylideneglycinato-aquo-copper(II), Sodium N-Salicylideneglycylglycinato-cuprate(II) and Related Compounds. ***Akitsugu Nakahara.*** *Chemical Society of Japan, Bulletin*, v. 32, no. 11, Nov. 1959, p. 1195-1199.

4038* Perfluoroalkyl Derivatives of Metals and Non-Metals. Review dealing with the chemistry and properties of the known perfluoroalkyl derivatives of the elements other than C, O, N, and the halogens. ***J. J. Lagowski.*** *Chemical Society, Quarterly Reviews*, v. 13, no. 3, 1959, p. 233-264.

4039* Newer Aspects of the Stereochemistry of Carbohydrates. ***R. J. Ferrier and W. G. Overend.*** *Chemical Society, Quarterly Reviews*, v. 13, no. 3, 1959, p. 265-286.

4040 Some Constituents of the High-Boiling Tar Acids. Forty-five phenols were identified in a sample of coal tar acids of vertical-retort origin. The method of separation was based on the butylation of close-boiling cuts. Twenty-two of the phenols had not previously been found in high-temperature tars and nine are new compounds. Derivatives were prepared and their melting points are listed. 5-Ethyl-3-methylphenol, 4- and 5-hydroxy-hydrindenes are the most abundant individual phenols boiling between the xylenols and the naphthols. ***R. E. Dean, E. N. White, and D. McNeil.*** *Journal of Applied Chemistry*, v. 9, pt. 12, Dec. 1959, p. 629-641.

4041* The Structure of 3,4-Dihydroxyazobenzene-4′-sulphonic Acid. Preparation from catechol and sulfanilic acid by two methods. Trans-configuration revealed by X-ray powder diffraction analysis and the strong H bonding found in infrared spectra are indicative of intermolecular association. ***L. M. Shorr and B. Bernas.*** *Research Council of Israel, Bulletin*, v. 8A, no. 3, Sept. 1959, p. 110-114.

4042* New Heteroaromatic Compounds. IV. The Nitration and Chlorination of 10-Methyl-10:9-borazarophenanthrene. Nitration with HNO_3 in acetic anhydride, and chlorination with Cl in acetic acid; the products were oriented and the proportions of isomers determined quantitatively. ***M. J. S. Dewar and Ved P. Kubba.*** *Tetrahedron*, v. 7, nos. 3-4, Nov. 1959, p. 213-222.

4043* Terpenoids. VI. A Novel Unambiguous Synthesis of DL-Ar-turmerone. New synthesis starting from DL-curcumone. DL-ar-turmerone occurs with turmerone as chief component of the essential oil from the rhizomes of *Curcuma longa* Linn. ***R. P. Gandhi, O. P. Vig, and S. M. Mukherji.*** *Tetrahedron*, v. 7, nos. 3-4, Nov. 1959, p. 236-240.

4044* Polymorphism in Substituted Barbituric Acids. Barbital, butethal, amobarbital, pentobarbital, thiopental, phenobarbital, aprobarbital, nostal, and kemithal were found to exist in polymorphic form. ***B. Cleverley and P. P. Williams.*** *Tetrahedron*, v. 7, nos. 3-4, Nov. 1959, p. 277-288.

4045* Furan Tetracarboxylic Acid. Furan tetracarboxylic acid forms well defined salts with a variety of bases. Its structure, and that of an intermediate in its preparation, is discussed in relation to its ultraviolet and infrared spectra. ***W. Cocker, W. J. Davis, T. B. H. McMurry, and P. A. Start.*** *Tetrahedron*, v. 7, nos. 3-4, Nov. 1959, p. 299-304.

4046 The Radiolysis of Organic Solutions: II. The Benzophenone-Propanol-2 System. Mixtures of benzophenone with propanol-2 were irradiated with Co-60 γ-rays. Yield of H_2 from propanol-2 is very sensitive to benzophenone addition. Addition of benzophenone also lowers the yield of CH_4 from propanol-2. Benzophenone probably functions principally as a H atom scavenger. ***J. G. Burr and J. D. Strong.*** *U. S. Atomic Energy Commission, NAA-SR-3695*, Dec. 1, 1959, 15 pp. (UF767 Un3.1na Contin.)

CHEMISTRY—PHYSICAL

4047* Addition Compounds of Olefins With Metal Salts. II. The Reaction of Ethylene With Silver Ions in Aqueous Solution. Equilibrium formation constants were determined at seven temperatures between 17.5 and 32.5 C. ***Paul Brandt.*** *Acta Chemica Scandinavica*, v. 13, no. 3, 1959, p. 1639-1652.

4048 Hydrogen Bonding Studies. II. The Acidity and Basicity of Silanols Compared to Alcohols. Acidity and basicity determined by the measurement of O-H stretching infrared band shifts upon admixture with the bases ether and mesitylene, and the acid phenol, respectively. ***Robert West and Ronald H. Baney.*** *American Chemical Society, Journal*, v. 81, Dec. 5, 1959, p. 6145-6148.

4049 The Kinetics of the Thermal Decompostion of 2,2′-Azo-bis-isobutyronitrile. Extent of formation of dimethyl-N-(2-cyano-2-propyl)-ketenimine, DKI, and the first-order rate constants for the decomposition of DKI and 2,2′-azo-bis-isobutyronitrile, AZO, estimated from a kinetic study of the breakdown of AZO in benzene solution at 60-80 C. ***P. Smith and S. Carbone.*** *American Chemical Society, Journal*, v. 81, Dec. 5, 1959, p. 6174-6177.

4050 A Study of the Kinetics of the Chloramine-Ammonia and Chloramine-Hydrazine Reactions in Liquid Ammonia. ***Francis Nash Collier, Jr., Harry H. Sisler, Jack G. Calvert, and Forrest R. Hurley.*** *American Chemical Society, Journal*, v. 81, Dec. 5, 1959, p. 6177-6187.

4051 Kinetics of the Decomposition of N_2O at High Temperature. Rates of thermal decomposition of N_2O, measured within the temperature range of 800 to 1000 C with the use of a flow technique and gas chromatography for product analysis. ***Wendell M. Graven.*** *American Chemical Society, Journal*, v. 81, Dec. 5, 1959, p. 6190-6192.

4052 Studies on the Effect of Heat on Deoxyribonucleic Acid. Chromatographic and sedimentation behaviors of these macromolecules are presented which indicate that all molecules do not react to thermal denaturation in a uniform manner. Salt

was found to exert a protective effect. ***Herbert S. Rosenkranz and Aaron Bendich.*** *American Chemical Society, Journal,* v. 81, Dec. 5, 1959, p. 6255-6259.

4053 The Heat of Formation of O_2F_2 and O_3F_2. Method developed for determining heats of formation of substances that decompose spontaneously below 0°. The heats of decomposition of liquid O_2F_2 and liquid O_3F_2 into gaseous O_2 and F were determined directly at temperatures of 190 and 121 K, respectively, by this method. ***A. D. Kirshenbaum, A. V. Grosse, and J. G. Aston.*** *American Chemical Society, Journal,* v. 81, Dec. 20, 1959, p. 6398-6402.

4054 The Thermodynamic Properties of Aqueous Sulfuric Acid Solutions and Hydrates From 15 to 300°K. The thermodynamic properties are given in tabular form both for varying temperatures and concentrations of acid. ***W. F. Giauque, E. W. Hornung, J. E. Kunzler, and T. R. Rubin.*** *American Chemical Society, Journal,* v. 82, Jan. 5, 1960, p. 62-70.

4055 A Kinetic Study of the Mechanism of Nitrosomethane Formation and Decay in the Photolysis of Azomethane-Nitric Oxide Mixtures. The infrared spectrum is used to determine the rates of formation and decay of nitrosomethane. ***Jack G. Calvert, Sandra S. Thomas, and Philip L. Hanst.*** *American Chemical Society, Journal,* v. 82, Jan. 20, 1960, p. 1-5.

4056* A Detailed Study of the Samuel-Magee Model for the Radiation Chemistry of Water. II. Kinetics of Radical Reactions in the Tracks of Densely Ionizing Particles. Kinetics of recombination of H and OH radicals, formed in liquid water along the track of a densely ionizing particle in the manner suggested by Samuel and Magee, were studied using an electronic computer. ***P. J. Dyne and J. M. Kennedy.*** *Canadian Journal of Chemistry,* v. 38, Jan. 1960, p. 61-76.

4057* Infrared Studies of Polyvinyl Alcohol by Deuteration of Its OH Groups. ***Hiroyuki Tadokoro.*** *Chemical Society of Japan, Bulletin,* v. 32, no. 11, Nov. 1959, p. 1252-1257.

4058 Electrolyte Solutions. Measurement and interpretation of conductance, chemical potential, and diffusion in solutions of simple electrolytes. ***R. A. Robinson and R. H. Stokes.*** 2nd Ed. 559 pp. 1959. Academic Press, New York. (QD553 R56e2)

4059 The Vapour Pressure and Lattice Energy of Carbon Tetrabromide. Vapor pressures of monoclinic and cubic CBr_4 over the respective temperature ranges 21.9-45.7 C and 47.9-55.7 C. Results are discussed in terms of a Lennard-Jones potential. ***R. S. Bradley and T. Drury.*** *Faraday Society, Transactions,* v. 55, Nov. 1959, p. 1844-1847.

4060 The Dissociation Constant of Phenol in Water Between 25°C and 60°C. Dissociation constant measured by the Harned potentiometric technique, utilizing buffered cells. ***E. H. Binns.*** *Faraday Society, Transactions,* v. 55, Nov. 1959, p. 1900-1903.

4061* Use of the Kinetic Tracer Method for Investigations on the Mechanism of *n*-Decane Liquid-Phase Oxidation. The changes in the mechanism of the reaction are related to the changes in the chain propagation reaction which is determined by the hydroperoxide formation and the branching rates. ***N. M. Emanuel, Z. K. Maizus, and L. G. Privalova.*** *International Journal of Applied Radiation and Isotopes,* v. 7, no. 2, Dec. 1959, p. 111-117.

4062 Lattice Vibrations in Alkali Halide Crystals. I. Lithium and Sodium Halides. Vibrational frequency distributions for the Li and Na halides evaluated on the basis of the Born lattice theory by the use of Blackman's numerical-sampling technique. ***Arnold M. Karo.*** *Journal of Chemical Physics,* v. 31, Dec. 1959, p. 1489-1499.

4063 Electron Impact Studies of Aromatic Hydrocarbons. I. Benzene, Naphthalene, Anthracene, and Phenanthrene. Systematic survey of ionization-dissociation processes of fused-ring aromatic compounds is initiated. ***Morton E. Wacks and Vernon H. Dibeler.*** *Journal of Chemical Physics,* v. 31, Dec. 1959, p. 1557-1562.

4064 Substituted Methanes. XXIX. Vibrational Spectra, Potential Constants, and Calculated Thermodynamic Properties for Dibromochlorofluoromethane and Bromodichlorofluoromethane. Raman displacements, semiquantitative relative intensities, and quantitative depolarization factors for the Raman lines of the liquid, and wave numbers and estimated relative intensities for the infrared bands of the gas and liquid in the region 400 to 3000 c/cm. ***Robert L. Gilbert, Edward A. Piotrowski, Jerome M. Dowling, and Forrest F. Cleveland.*** *Journal of Chemical Physics,* v. 31, Dec. 1959, p. 1633-1636.

4065 Reaction Products of Atomic Hydrogen With Solid Ozone. ***Paul A. Giguère and David Chin.*** *Journal of Chemical Physics,* v. 31, Dec. 1959, p. 1685-1686.

4066 The Calorimetric Determination of Purity. Theory and Calculation Methods. Theoretical basis for purity calculation is extended to include samples forming moderately non-ideal solutions. Two cases are considered involving: (1) moderately concentrated, solid-insoluble impurities, and (2) a single, dilute, solid-soluble impurity. Equations relating fraction melted or heat content of the sample and temperature are developed from mass and energy conservation equations and thermodynamic relations for solid-liquid phase compositions. ***J. H. Badley.*** *Journal of Physical Chemistry,* v. 63, Dec. 1959, p. 1991-1996.

4067 Vapor Pressure of Diborane. Vapor pressure was measured from 151.2 to 288.5 K. In this range, it varied from 0.14 to 38.3 atm. The normal boiling point was found to be 180.59 ± 0.04 K. ***Leo J. Paridon and George E. MacWood.*** *Journal of Physical Chemistry,* v. 63, Dec. 1959, p. 1997.

4068 The Heat of Vaporization of Diborane. Heat of vaporization was measured calorimetrically from the normal boiling point to within four degrees of the critical point. Over this range, the heat of vaporization as a function is given by the expression $L_v = 546.2\ (T_c - T)^{0.39}$ cal. mole^{-1}, where T_c is the critical temperature, 289.7 K. ***Leo J. Paridon, George E. MacWood, and Jih-Heng Hu.*** *Journal of Physical Chemistry,* v. 63, Dec. 1959, p. 1998-1999.

4069 Oxygen Sorption and Electrical Conductivity of Copper Oxide Films. An experimental apparatus that allows simultaneous measurement of the electrical conductance of thin films and the uptake of gases by these films was used to study the kinetics of O_2 uptake by Cu_2O films and the effect of this uptake on the electrical conductance of the film. Results indicate that rate of O_2 uptake depends on conductance of the film, that the relationship between conductance and gas uptake is not simple, and that an incorporation step, which is not apparent from gas uptake measurements alone, can be followed by conductance changes. ***A. W. Smith and H. Wieder.*** *Journal of Physical Chemistry,* v. 63, Dec. 1959, p. 2013-2016.

4070 Liquids and Liquid Mixtures. Collective treatment of both the theory and practice of the study of liquid mixtures and of liquids. Includes an account of the equilibrium properties of pure liquids and the development of new methods for the calculation of the thermodynamic properties; description of the equilibrium properties of liquid mixtures; full account of the theories of liquids and of mixtures, developing those parts of statistical thermodynamics that are common to all theories and then restricting the account to results that can be compared directly with experiment. ***J. S. Rowlinson.*** 360 pp. 1959. Academic Press, New York. (QC145 R79L)

4071* The Thermodynamic Stability of Iron and Its Compounds in Hydrothermal Media. ***P. K. Foster.*** *New Zealand Journal of Science,* v. 2, no. 3, Sept. 1959, p. 422-430.

4072 Physical Properties of Liquid Xylenes. Nomograph gives a summary of the physical properties of the three isomeric liquid xylenes. ***A. M. P. Tans.*** *Petroleum Refiner,* v. 39, Jan. 1960, p. 170.

4073* Molten Salts. Electrolyte properties; methods of investigation; structure of pure molten salts; solution in molten salts. ***H. Bloom.*** *Reviews of Pure and Applied Chemistry,* v. 9, no. 3, Sept. 1959, p. 139-168.

4074* Infrared Spectra of SiF_3H, SiF_3D, SiD_3F and SiD_3Cl. Infrared spectra obtained under prism dispersion; assignment of fundamental modes. ***C. Newman, S. R. Polo, and M. K. Wilson.*** *Spectrochimica Acta,* 1959, no. 10, Nov., p. 793-799.

4075* Spectra and Structure of 4-Hydroxycoumarins. Infra-red spectra of eight 4-hydroxycoumarins, in dioxan solution and in the solid state, indicate that they have coumarin and not the tautomeric chromone structures. Vibrations involving the hydroxyl groups of three crystalline 4-hydroxycoumarins are identified by deuteration. ***V. C. Farmer.*** *Spectrochimica Acta,* 1959, no. 10, Nov., p. 870-882.

4076 Equations of State of Liquid and Gaseous Normal Hydrogen and the Application of Multiple Regression Techniques to Curve Fitting. Analytical expressions are presented which describe the P-V-T surface of gaseous and liquid normal H with a precision of 5%. The use of multiple regression techniques for the reduction of experimental data is discussed as well as adaption for use with an IBM 704 computer. ***R. H. Sherman, et al.*** *U. S. Atomic Energy Commission, LAMS-2357,* Oct. 8, 1959, 29 pp. (UF767 Un3.1La Contin.)

4077* Kinetics and Mechanism of the Oxidation of Thallous Ion by Cerie Ion. I. II. Detailed study of this reaction in presence of trivalent and tetravalent Mn. ***B. Krishna and B. P. Sinha.*** *Zeitschrift für Physikalische Chemie* (Leipzig), v. 212, nos. 3-4, 1959, p. 149-166.

See also: **4114** (viscosity of Mg soap solutions).

COATINGS

4078* 'Hot-Melt' Adhesives. *Adhesives & Resins,* v. 7, Dec. 1959, p. 113-116.

4079* Titanium Pigments and the Effect of Particle Size on Printing Inks. ***Howard C. Spreen.*** *American Ink Maker,* v. 38, Jan. 1960, p. 32 + 5 pages.

4080 Fluidized Bed—A New Manufacturing Tool. Finely powdered materials—such as metals, plastics, or ceramics—are placed in a tank and churned into a rolling, flowing, liquid-like condition by compressed air, or other gases; the suspended particles form a "fluidized bed". In this "bath", parts can be coated to provide new finishes. ***William M. Stocker, Jr.*** *American Machinist,* v. 103, Dec. 28, 1959, p. 72-73.

4081* Reactions of Unsaturated Fatty Alcohols. VII. Polymerization of Vinyl Ethers Catalyzed by Stannic and Ferric Chlorides. ***E. J. Dufek, et al.*** *American Oil Chemists' Society, Journal,* v. 37, Jan. 1960, p. 37-40.

4082* Search for New Industrial Oils. II. Oils With High Iodine Values. Twelve seed oils are reported with iodine values above 180. ***F. R. Earle, et al.*** *American Oil Chemists' Society, Journal,* v. 37, Jan. 1960, p. 48-50.

4083 Anti-Corrosion Manual. Theory of corrosion; corrosion in industry; resistant materials and their applications; preparatory treatments for protective coatings; protective coatings; pipe coatings and tapes; protective packaging; and boiler water treatments. 326 pp. 1959. Corrosion Prevention and Control, London. (TA462 An87 Vis.)

4084* The Effect of Water and Some Proteins, Carbohydrates and Emulsifying Agents on the Autoxidation of Methyl Linoleate. ***Lars-Olov Spetsig.*** *Arkiv för Kemi,* v. 14, no. 6, 1959, p. 527-534.

4085 Characteristic Properties of Polyurethane Protective Coatings. Explains data from chemical and solvent resistance tests, spot tests, and other laboratory research. ***E. R. Wells.*** *Corrosion,* v. 15, Dec. 1959, p. 93 + 2 pages.

4086* Metallic Lead as a Pigment for Anti-Corrosive Paints. ***J. A. Calcutt.*** *Corrosion Prevention & Control,* v. 6, Nov. 1959, p. 34-38.

4087 Stable Furfuryl Alcohol Impregnating Solutions. Use of selected catalysts permits premixing of the impregnating solution so it is always ready for use. ***Irving S. Goldstein and William A. Dreher.*** *Industrial and Engineering Chemistry,* v. 52, Jan. 1960, p. 57-58.

4088 Protective Coatings. ***Harry Burrell.*** *Industrial and Engineering Chemistry,* v. 52, Jan. 1960, p. 59A-60A.

4089 1,10-Phenanthroline Drier Catalyst Activity in Organic Coatings. Drying data on commercial alkyds reveal the presence of metal complexes and tell what chemical species is the most active drier. ***W. H. Canty, G. K. Wheeler, and R. R. Myers.*** *Industrial and Engineering Chemistry,* v. 52, Jan. 1960, p. 67-70.

4090 Painting the Navigation Unit for B58 Hustlers. Unit is the main spring of the plane and its mission. ***P. C. Bardin.*** *Industrial Finishing,* v. 36, no. 3, Jan. 1960, p. 104-106.

4091 The Problem of Painting Rusty Steel. Paint applied to rusty steel when the ferrous sulphate content is lowest has the best durability. ***J. E. O. Mayne.*** *Journal of Applied Chemistry,* v. 9, pt. 12, Dec. 1959, p. 673-680.

4092* Corrugated Fiberboard Box for Fruit Transportation. III. Carbon Dioxide, Temperature and Humidity in Waterproof or Water-Repellent Fiberboard Packaging. (*In Japanese.*) ***Yoshio Hasegawa and Yae Kuramochi.*** *Journal of Railway Engineering Research,* v. 16, July 1959, p. 326-328.

4093* Zinc Coatings on Iron and Steel. III. Corrosion Resistance of Zinc Coatings. ***A. K. Parker.*** *Metal Finishing Journal,* v. 5, no. 60, Dec. 1959, p. 445-453.

4094* The Coated Steels. I. Aluminized Steel. ***Lester F. Spencer.*** *Metal Products Manufacturing,* v. 17, Jan. 1960, p. 34-35.

4095* Low Temperature Porcelain Enameling at Frigidaire. A one-year conversion program, involving seven ground coats and 20 cover coats, proves successful in a six continuous-furnace plant. ***G. B. Hughes and R. J. Baker.*** *Metal Products Manufacturing,* v. 17, Jan. 1960, p. 38-39.

4096* Inks for Magnetic Printing. Will now print just about any form including halftone work on most stocks and on most presses. ***G. L. Erikson.*** *National Lithographer,* v. 67, Jan. 1960, p. 30-32.

4097* A Controlled Condensation Technique for Evaluating the Resistance of Paint Films to Humidity. ***K. L. Jones.*** *Oil & Colour Chemists' Association, Journal,* v. 42, Dec. 1959, p. 838-843.

4098* Effect of Release Agents and Additives on the Adhesion of Latex and Alkyd Paints to Plaster. ***E. Hoffmann and M. J. Ridge.*** *Oil & Colour Chemists' Association, Journal,* v. 42, Dec. 1959, p. 844-848.

4099* A Study in Paint Vehicles: III. Solubility, EDM, Aniline Points and Dilution Ratios. ***L. Dintenfass.*** *Oil & Colour Chemists' Association, Journal,* v. 42, Dec. 1959, p. 849-865.

4100* Developments in Aerosol Coatings. I. ***E. G. Roberts.*** *Paint and Varnish Production,* v. 50, no. 1, Jan. 1960, p. 89 + 3 pages.

4101 Paint Finishing in Industry. Pretreatment of ferrous metals; pretreatment of nonferrous metals; spray painting with compressed air atomization; airless and electrostatic spraying; radiant stoving equipment; intermediate and after treatments. ***A. A. B. Harvey.*** 488 pp. 1958. Robert Draper Limited, Middlesex, England. (TT305 H26p)

4102* The Role of Aluminum Alkoxy Derivatives as Vehicle Modifiers. ***G. D. Duro and A. Mudrak.*** *Paint Industry Magazine,* v. 75, Jan. 1960, p. 18 + 2 pages.

4103 Glycerol Alkyds Have Many Uses. Advantages to be gained in several fields of application are summarized. ***S. E. Canning and S. T. Harris.*** *Paint Manufacture,* v. 29, Dec. 1959, p. 389 + 3 pages.

4104 Condensation Polymers. Discusses reaction kinetics affecting condensation reactions and outlines the chemistry of cellulose polymers. ***P. M. Fisk.*** *Paint Manufacture,* v. 29, Dec. 1959, p. 393-396.

4105* How PVAc Emulsion Adhesives Keep Pace With Packaging. Having many excellent properties, these adhesives are expected to provide even more diverse specialty applications than they handle today. ***Paul Weitz.*** *Paper, Film and Foil Converter,* v. 34, Jan. 1960, p. 25-29.

4106* Water-Thinned Industrial Coatings. *R. J. Woodbridge.* *Product Finishing,* v. 12, Dec. 1959, p. 77-80.

4107 Brittle Lacquers. Factors influencing the behavior and development of lacquers are briefly considered, as well as attempts to overcome difficulties. ***J. R. Linge.*** *Research,* v. 13, Jan. 1960, p. 18-25.

4108* Hot-Dip Galvanizing in Continuous Strip Operation. Corrosion of steels and cathodic protection of Fe by Zn is discussed. The Sendizimir process facilitates adhesion of the Zn coating because of slight oxidation of the strip, followed by reduction which gives a film of pure Fe. Describes galvanized sheets produced at the Montataire plant. (*In French.*) La galvanisation au trempe a chaud en bande continue. ***J. Lasbleis.*** *Revue de Metallurgie,* v. 56, Dec. 1959, p. 375-386.

4109* Low Molecular Weight Polyethylenes in Paperboard Coatings. *Robert Rosenbaum.* *SPE Journal,* v. 16, Jan. 1960, p. 90-92.

4110* The Chemistry and Application of Rug-Backing Compounds. I. *George Brawner.* *Textile World,* v. 110, no. 1, Jan. 1960, p. 79 + 2 pages.

4111* Some Further Flux Trails With Polyethylene Glycol. *W. R. Lewis.* *Tin and Its Uses,* no. 48, Autumn 1959, p. 5-6.

4112* Breakthrough for Titanium-Clad Vessels. *Welding Design & Fabrication,* v. 33, Jan. 1960, p. 46-47.

4113* Electroless Nickel Alloy Coating Gives Uniform Hard Corrosion-Resistant Deposit. *Ladd Kuzela.* *Western Metalworking,* v. 17, Dec. 1959, p. 34-36.

4114* A Study of Viscosity of Non-Aqueous Solutions of Magnesium Stearate and Oleate. *A. N. Bose and Virendra K. Dixit.* *Zeitschrift für Physikalische Chemie* (Leipzig), v. 212, nos. 3-4, 1959, p. 123-126.

See also: **3914** (silicon coatings and heat transfer coefficients).

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

4115* Automatic Programming for Automatic Computers. Complex statistical and data processing problems can be programmed with little or no knowledge of the computer code. An example is given of an automatically programmed one way analysis of variance *F* computation. ***Mitchell O. Locks.*** *American Statistical Association, Journal,* v. 54, no. 288, Dec. 1959, p. 744-754.

4116 An Introduction to Electronic Data Processing. Such problems as: a civilization learns to count, giant computer systems and how they work, the language of the computer, the electronic principle, computer applications, personnel organization for electronic data, training for electronic data processing system, and a description of selected electronic data are discussed. ***Roger Nett and Stanley A. Hetzler.*** 287 pp. 1959. Free Press, Glencoe, Ill. (TK7885 N38i)

4117* Fingers or Fists? The binary number system offers many advantages over a decimal representation for a high-performance, general-purpose computer. The greater simplicity of a binary arithmetic unit and the greater compactness of binary numbers both contribute directly to arithmetic speed. In applications requiring the processing of a large volume of inherently decimal input and output data, the time for decimal-binary conversion needed by a purely binary computer may be significant. ***W. Buchholz.*** *Association for Computing Machinery, Communications,* v. 2, Dec. 1959, p. 3-11.

4118* A Queue Network Simulator for the IBM 650 and Burroughs 220. The core simulator is intended to be a research device rather than the basis of a routine operating procedure for a production control operation. As such, flexibility and susceptibility to modification were considered more important in its construction than speed of operation for a particular situation. ***R. W. Conway, B. M. Johnson, and W. L. Maxwell.*** *Association for Computing Machinery, Communications,* v. 2, Dec. 1959, p. 20-23.

4119 Automation Today and Tomorrow. Warehousing, instrumentation in the process industries, automation in specific industries, different kinds of industries, automation in the U.S.S.R., management theory and techniques, economic and social implications, production engineering and many other problems are discussed. ***L. Landon Goodman.*** 158 pp. 1958. Essential Books, Fair Lawn, New Jersey. (TJ215 G62a)

4120 Mechanical Design of a Flying-Spot Store. The experimental electronic switching system (ESS) uses a semi-permanent memory called the "flying-spot store." This unit stores bits of control data in the form of dots on small photographic plates, and employs unique mechanical, optical and electronic techniques for the retrieval of digital information. ***D. C. Koehler and J. J. Madden.*** *Bell Laboratories Record,* v. 38, Jan. 1960, p. 14-17.

4121 The Nike Ajax Computer. Significant to the Bell System's philosophy of missile guidance is the continuous interplay of information among the radars, the missile and the target. In the Nike Ajax system, this information is processed by a specially adapted analog computer. ***W. E. Ingerson.*** *Bell Laboratories Record,* v. 38, Jan. 1960, p. 26-30.

4122* Automatic Control in Russia. There is progress in the Soviet Union in most of the fields of industrial control, and analogue technique and digital computers are used as required. There is considerable activity in control in the steel industry, in telemetry, and in connection with electric power systems with long transmission lines. ***A. Asbury.*** *Control,* v. 2, no. 18, Dec. 1959, p. 102-104.

4123* Handling Nuclear Data. The Measurement and Control Section of the I.E.E. talked over "Data Handling Problems in Atomic Installations" when they met on Tuesday, December 15. Speaker enlarges on the remarks he made, and reports the discussion that followed. ***Denis Taylor.*** *Control,* v. 3, no. 19, Jan. 1960, p. 98-100.

4124 Control Enters a New Decade. The pace of control will accelerate and its province will expand into a broad universe of automatic systems—led by automatic information systems and closely followed by emphasis on larger capacities and faster speeds of power converters and actuators. ***William E. Vannah.*** *Control Engineering,* v. 7, Jan. 1960, p. 101-107.

4125 A Comparison of Integral and Incremental Digital Computers for Process Control Applications. The suitability of a digital computer for a particular control application depends on such factors as computation speed, logical and mathematical capabilities, input-output requirements, and reliability and maintainability. Integral and incremental computers each have inherent and distinctive design and operational features. ***Edward L. Braun.*** *Control Engineering,* v. 7, Jan. 1960, p. 113-118.

4126* Numerical Controller Uses Magnetic Counters. The use of highly reliable, subminiature magnetic counters makes this controller uniquely adaptable to many applications in which the job to be performed involves the counting of pieces, revolutions, units of length, etc. ***Carl Isborn.*** *Electrical Manufacturing,* v. 64, July 1959, p. 93-97.

4127* Design by Transfer Function Methods. The transfer function of a system results from the combining of the transfer functions of the devices that make up the system. By various means the system function can be analyzed to determine whether or not the design is basically sound and, if not, in what way it should be altered to make it so. ***Ira Ritow.*** *Electrical Manufacturing,* v. 64, July 1959, p. 134-143.

4128 A High-Speed Ferrite Storage System. A square loop ferrite storage system is described which overcomes the limita-

tion on speed imposed by the core material when used in a conventional store using coincident drive selection. Each digit is stored as a difference in flux levels in two cores which are only partially switched during the writing operation. Measurements made on a pair of cores show how the output during reading varies with write pulse duration and amplitude. ***C. J. Quartly.*** *Electronic Engineering*, v. 31, Dec. 1959, p. 756-758.

4129* Automatic Character Recognition. Following an introductory survey of some of the principal automatic character recognition systems that are currently in either the production or research stage, the fundamental semantic features and limits of character patterns are discussed. Demonstrates that by an analysis of these limiting features, it is possible to formulate definitions of character patterns that are particularly amenable to translation in terms of discriminatory logic. ***D. A. Young.*** *Electronic Engineering*, v. 32, Jan. 1960, p. 2-10.

4130* The Construction of a Digital-Computing System From a Basic Transistor Circuit. It is possible to build a complete digital-computing system by interconnecting a number of identical basic circuits. One method uses a basic circuit consisting of one transistor, one capacitor, and three resistors, and a special-purpose computer with a built-in program for binary-decimal conversion has been constructed to demonstrate the application of the method. ***P. L. Cloot and G. E. Jackson.*** *Electronic Engineering*, v. 32, Jan. 1960, p. 37-43.

4131 Transfer-Function Discovery on the PACE Analogue Computer. Experimental work on the PACE analogue computer has shown that, by a 'mask' matching technique, the unknown constants of a transfer function, up to a maximum number of four, may be readily determined within a few minutes to any desired accuracy. ***J. H. Milsum.*** *National Research Council of Canada, Mechanical Engineering Report*, MK-2, Feb. 1959, 34 pp. (TJ1 N21.5m Contin.)

4132 The Punched Card Machine Accounting and Data Processing Semi-Annual. A business publication. v. VIII. 171 pp. 1959. Gille Associates, Inc., Detroit. (HF5371 P96 Over.)

See also: **4230** (control analysis of power systems); **4597** (computer for hot plate-rolling mill).

ELECTRICAL ENGINEERING

4133 The Strange New Ball Motor. The latest discovery is the spherical induction motor, which departs radically in form and principle from conventional squirrel cage types. Although yet unproven, it provides a unique base for further studies. ***E. R. Laithwaite.*** *Control Engineering*, v. 7, Jan. 1960, p. 131-135.

4134* Gaussian-Response Filter Design. Filters having a Gaussian response shape are useful in pulse systems because of the small under- and overshoots or ringing they produce following rapid signal changes. A resumé of the magnitude, phase, impulse response, step response, and effective thermal noise bandwidth of perfect Gaussian filters is given. A low-pass and a band-pass design example are given. ***Milton Dishal.*** *Electrical Communication*, v. 36, no. 1, 1959, p. 3-26.

4135* Transformers for 70-Megacycle Intermediate-Frequency Amplifiers. Requirements for wide-band intermediate-frequency amplifiers centered on 70 megacycles per second for microwave systems have created a demand for small transformers that can be manufactured to close limits of self-inductance and coupling coefficient. ***W. F. Glover and E. D. Peakall.*** *Electrical Communication*, v. 36, no. 1, 1959, p. 27-29.

4136* Thermal Noise in Multisection Radio Links. Microwave radio links are used for the long-distance transmission of large groups of telephone channels and for television signals. Thermal noise effects arise in each section of the link and the magnitude of the resulting noise in the over-all circuit is one of the major parameters of the over-all transmission circuit. ***B. B. Jacobsen.*** *Electrical Communication*, v. 36, no. 1, 1959, p. 42-59.

4137* Electrochemical Auxiliary Power Sources for Missiles and Space Flight. Relatively high energy per unit weight, high power density, and high reliability are among the basic advantages of electrochemical power sources, which are being developed for missile and space flight applications. These sources, particularly electrochemical fuel cells, are described and compared with other energy-conversion devices. ***M. Eisenberg.*** *Electrical Engineering*, v. 79, Jan. 1960, p. 58-63.

4138* D-C Torque Motors for Servo Applications. The development of torque motors for servo applications has progressed to the point where units of various sizes and performance capabilities are commercially available. They can be manufactured to meet a variety of severe environmental conditions and are being widely and successfully applied as electromagnetic transducers. ***D. G. O'Brien.*** *Electrical Manufacturing*, v. 64, July 1959, p. 76 + 6 pages.

4139* Relay Test Code Advanced. The relay industry's common-purpose pooling of its top design and application engineering talents is now showing strong tangible results in the form of experience-formulated test standards and methods and definitions of terms. ***Arnold E. Rudahl.*** *Electrical Manufacturing*, v. 64, July 1959, p. 81-92.

4140* The Electric Field. Basic principles of electrostatics are cited. Discussion covers electric induction, capacitance, effects of dielectric, mechanical factors and field effects in practical devices. A summary of vector analysis notation is included. ***Paul G. Jacobs.*** *Electrical Manufacturing*, v. 64, July 1959, p. 107-118.

4141* A Transistorized Current Stabilizer for an Electromagnet. Power transistors can be used to control large currents, but their rated maximum voltage is lower than desirable. By using an auxiliary electromechanical control system on the input to a stabilizer, this voltage limitation can be overcome. ***J. C. S. Richards.*** *Electronic Engineering*, v. 32, Jan. 1960, p. 22-23.

4142 Aircraft Secondary Power Generator With Direct Compensation Frequency Control. The method employed is completely electrical. The principle of operation depends upon a constant angular velocity magnetic field in the alternator armature, the angular velocity being the vector sum of the mechanical velocity of the shaft and the velocity of an electromagnetic rotating field induced by the excitation of a polyphase field winding. ***L. J. Johnson and S. E. Rauch.*** *IRE Transactions on Component Parts*. v. CP-6, no. 4, Dec. 1959, p. 259-263. (TK1 In6.6cp Vis.)

4143 Delay-Line Specifications for Matched-Filter Communications Systems. Specifications for a wide-band multitap delay-line are rationalized by the demands of a matched-filter communication system employing a pair of such delay lines. The delay line is specified in terms of time-domain characteristics. ***R. M. Lerner, B. Reiffen, and H. Sherman.*** *IRE Transactions on Component Parts*, v. CP-6, no. 4, Dec. 1959, p. 263-268. (TK1 In6.6cp Vis.)

4144* Some Recent Developments in Electrical Insulation. Electrical plant and equipment develop heat in operation. The present practice is to remove the conductor heat without damage to the insulation and to ensure long life for the latter by retarding degradation. Existing insulating materials are being improved and new materials, especially synthetic types, are being produced with more stable electrical and thermal characteristics. ***J. Ashmore.*** *Institution of Electrical Engineers, Journal*, v. 5, no. 60, Dec. 1959, p. 695-699.

4145* The Selection of Insulation Levels and Tests for High-Voltage Transformers. A pattern for the over-all insulation strength of a transformer, relative to service conditions, is developed from examination of test procedure, insulation characteristics, variation in voltage waveform, voltage transfer to other windings, and the influence of associated apparatus. A survey of service experience and fault statistics for the British high-voltage networks is made, indicating that there would be no advantage to change the present methods of surge protection. ***G. B. Harper.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. A, no. 30, Dec. 1959, p. 429-445.

4146* Detection of Transmission Errors in 5-Level Punched Tape. At the present time only empirical figures can be given on the effectiveness of this system in detecting transmission errors. While the precise distribution of errors is not yet known, experience and tests to date have given an indication of the general pattern of equipment and line errors. ***Robert Steeneck and Harold F. Caley.*** *Western Union Technical Review*, v. 14, no. 1, Jan. 1960, p. 2-8.

4147* Eddy Current Speed Control for Facsimile Telegraph Apparatus. Operation of transmitters and recorders "in phase" is requisite in design of facsimile systems. An economically made, compactly packaged eddy current brake with continuous servo loop speed correction and low over-all heat dissipation can assure efficient synchronization. ***Harry F. Burroughs.*** *Western Union Technical Review*, v. 14, no. 1, Jan. 1960, p. 9-13.

4148* A Communication Power Supply Utilizing Transistors. Both theory and experience provide information by means of which power supply units may be designated to meet requirements of the particular developments with which the units are associated. A case history report helps make the theory more readily understood. ***William Corkutt.*** *Western Union Technical Review*, v. 14, no. 1, Jan. 1960, p. 24-30.

See also: **3918** (electrolytic iodate production); **4455** (conduction of current in bearings).

ELECTROCHEMISTRY

4149 Anodizing at Reynolds Metals. General discussion of automatic anodizing installation. ***J. H. Dedrick.*** *Electroplating and Metal Finishing*, v. 12, Dec. 1959, p. 465 + 3 pages.

4150 Decorative Anodizing in Great Britain. Draws attention to a fundamental difference between English and American decorative anodizing practice. American manufacturers mechanically polish on elaborate and expensive automatic machines and then chemically brighten in a simple phosphoric acid/nitric acid/water mixture which has no leveling properties. In Great Britain industry is reluctant to make the large capital investment necessary for automatic mechanical polishing lines for articles of complicated shape and prefer to use a leveling-type of chemical polishing solution followed by anodizing on metal which is fabricated carefully to maintain its good initial surface. ***P. F. Walmsley.*** *Electroplating and Metal Finishing*, v. 12, Dec. 1959, p. 468-470.

4151* Electrolytic Brightening of Aluminium. Rate of electrodeposition is controlled so that formation of the anodic oxide barely exceeds solution of the oxide film. A uniformly bright surface of high reflectivity is obtained. ***G. Fitzgerald Lee.*** *Product Finishing*, v. 12, Dec. 1959, p. 54-56.

4152* Titanium Jigs Are Justified. Reports experience with racks for electroplating and especially anodizing, made of the new lightweight and corrosion resisting, but expensive metal, Ti; use is justifiable. ***J. C. Jones.*** *Product Finishing*, v. 12, Dec. 1959, p. 81-83.

4153* The Testing and Examination of Electrodeposits. I. Measurement of luster; the nature of luster and brightness, bloom and haze; gloss scales and criteria; glossmeter design. ***R. Quarendon.*** *Product Finishing*, v. 12, Dec. 1959, p. 90-93.

See also: **4530** (electrolytic polishing).

ELECTRONICS

4154* Transistor ac Amplifiers With High Input Impedance: A Survey. Various circuits are presented and their level of performance indicated. The two important design criteria for these amplifiers, bias point stability and low noise figure, are discussed. ***J. A. Ekiss.*** *Audio Engineering Society, Journal*, v. 8, no. 1, Jan. 1960, p. 18-22.

4155* A Survey of Some New Tubes for Audio Output Applications. Four recently announced pentodes and two rectifiers, covering the range of 14- to 60-w push-pull output, are discussed along with analysis of operating conditions, performance, and circuit design precautions. Discussion of safety factors on overload vs published ratings is also given. ***Robert E. Moe.*** *Audio Engineering Society, Journal*, v. 8, no. 1, Jan. 1960, p. 34-36.

4156* Properties of Base Materials Used for the Manufacture of Magnetic Recording Tape. Manufacturers of base materials have recognized the importance of the magnetic recording industry and now manufacture variations of their standard sheeting products designed especially for our industry. In acetate base, the manufacturer has two choices—triacetate or diacetate. These will be compared. ***Edward Schmidt.*** *Audio Engineering Society, Journal*, v. 8, no. 1, Jan. 1960, p. 52-57.

4157 A Miniature Lacquer-Film Capacitor. Describes a supported lacquer-film capacitor developed at Bell Laboratories which has the same capacitance as a mica unit twenty times its size. ***H. G. Wehe and J. K. Werner.*** *Bell Laboratories Record*, v. 38, Jan. 1960, p. 18-22.

4158* The Drift of Electronics. Discusses the development of electronics and concludes that in the future new developments could be of high importance in this field. ***Lucien Hix.*** *British Institution of Radio Engineers, Journal*, v. 19, Dec. 1959, p. 741-751.

4159 Circuit Theory of Linear Noisy Networks. Linear noisy networks in the impedance representation, impedance formulation of the characteristic-noise matrix, canonical form of linear noisy networks, linear noisy networks in other representations, noise measure, and network realization of optimum amplifier noise performance are discussed. ***Hermann A. Haus and Richard B. Adler.*** 79 pp. 1959. John Wiley & Sons, New York. (TK7870 H29c)

4160* On the Design of Some Rhombic Antenna Arrays. The expression of the field radiated by a rhombic antenna, taking into consideration both the vertical and the horizontal polarization components, is used to establish the theory of the array of two stacked rhombics and of the array of four rhombics in a stacked and interlaced arrangement. ***A. A. De Carvalho Fernandes.*** *Electrical Communication*, v. 36, no. 1, 1959, p. 30-41.

4161* Refractive Index of the Atmosphere as a Factor in Tropospheric Propagation Far Beyond the Horizon. Recent measurements indicate, however, that the relation existing between transmission loss and the refractive index of the atmosphere may enable estimates to be made, from climatic data alone. ***R. E. Gray.*** *Electrical Communication*, v. 36, no. 1, 1959, p. 60-69.

4162* Transient Junction Temperatures in Power Transistors. Very little information is presently available on transistor junction temperatures for pulsed input waveforms. In the study described, a simple thermal model of a power transistor is assumed and a heat-flow analysis of the model, using Laplace transforms, is made. ***W. W. Grannemann and J. D. Reese.*** *Electrical Engineering*, v. 79, Jan. 1960, p. 53-57.

4163* Dielectric Requirements in Microwave Equipment. Primary requirements for dielectric materials in microwave applications are discussed. Characteristics of silicone alloy materials for these applications are summarized and design case histories given. ***Charles L. Petze, Jr.*** *Electrical Manufacturing*, v. 64, July 1959, p. 128-133.

4164 Rare Earth Compound Semiconductors. The selenides of La, Er, and Y, and tellurides of La, Er, Gd, and Y were prepared by direct reaction of the elements. Measured electrical characteristics indicate semiconducting behavior, with the possibility that a wide range of properties can be obtained within these series of rare earth compounds. Observed room-temperature resistivities, for example, ranged from about 10^{-4} ohm-cm for La_2Te_3 and ErSe to the insulator range for Y_2Se_3. All the compounds prepared possess high melting points (1400-2000 C) and exhibit good thermal stability. The dissociation pressure of Gd_2Te_3 at its melting point appears to be as low

as 0.01 atm. ***J. F. Miller, F. J. Reid, and R. C. Himes.*** *Electrochemical Society, Journal*, v. 106, Dec. 1959, p. 1043-1046.

4165 Automatic Control of Distortion in Wideband Frequency Modulated Microwave Links. Discusses the problem of distortion generated in broad band frequency modulated microwave links by nonuniform group-delay characteristics in r.f. amplifiers. Describes an experimental automatic equalizer correcting group delay slope and gives results obtained on a 600 channel circuit. Methods of correcting higher orders of distortion are indicated. ***J. Tolman.*** *Electronic Engineering*, v. 31, Dec. 1959, p. 722-725.

4166 Wide-Band Analysis of Valve Phase-Splitting Circuits. A phase-splitting circuit which is an electronic counterpart of a balanced output transformer has two outputs whose voltages are ideally equal in magnitude but 180° apart in phase. This ideal operation is realized at low frequencies. Interelectrode capacitances alter the output relations at higher frequencies, and this effect is analyzed. It is found that near ideal operation to moderately high frequencies can be obtained by using suitable equal load impedances. ***L. J. Giacoletto.*** *Electronic Engineering*, v. 31, Dec. 1959, p. 733-735.

4167 High Frequency Transistor Filter Synthesis. For purposes of simplification the transistor intrinsic feedback, which is very small in diffused base units, is neglected. Two canonical ladder structures, of hybrid-π and of hybrid-T type, respectively, are considered for the synthesis of complex pole pairs. ***L. M. Vallese.*** *Electronic Engineering*, v. 31, Dec. 1959, p. 748-752.

4168 Variation of Input Conductance of a Grounded Base Junction Transistor. Investigates the problem of variation of input conductance of a grounded base junction transistor with the input d.c. current. Methods are suggested for maintaining this variation linear over a wide range of values of current and also for reducing the thermal drift. Performances of an amplitude modulator and an analogue multiplier using a transistor incorporating these features are described. ***S. Deb and J. K. Sen.*** *Electronic Engineering*, v. 31, Dec. 1959, p. 753-755.

4169* The Characteristics and Applications of Corona Stabilizer Tubes. The corona discharge used for voltage stabilization takes place in hydrogen between a cathode cylinder and an axial wire anode. Apart from thermal effects which become significant in higher voltage tubes, the discharge behaves approximately as a constant voltage in series with a resistance. These two parameters depend on the electrode radii and the gas pressure. The characteristics of tubes with subminiature, B7G and B9A envelopes covering a range of 350V to 7kV are given. ***E. Cohen and R. O. Jenkins.*** *Electronic Engineering*, v. 32, Jan. 1960, p. 11-15.

4170* Analysis of the Transistor Cascode Configuration. Fixed component neutralization as used in the production of tuned amplifiers is often difficult to achieve, due to the spread in transistor parameters. A transistor cascode amplifier does not require neutralization but has less gain than two stages in the grounded emitter configuration. This article investigates to what extent the internal feedback and gain are reduced. ***J. R. James.*** *Electronic Engineering*, v. 32, Jan. 1960, p. 44-48.

4171 Spectrum Analyzer Supplies Permanent Record. Simultaneous operation of many filters and read-out devices eliminates the scanning or commutation, required in the earlier equipments. The range of bandwidths and numbers of channels that can be accommodated make this a powerful new technique in signal analysis and search. ***Richard J. Farber and Alexander Proudfit.*** *Electronic Industries*, v. 19, Jan. 1960, p. 28-72.

4172 For H-F Circuit Design. . . . Applying Transistor "Y" Parameters. For h-f applications, the transistor can be considered as a linear active two-port network, which can be specified at a particular frequency by a set of four different parameters. One of the most commonly used is the "y" parameter. ***V. G. K. Reddi.*** *Electronic Industries*, v. 19, Jan. 1960, p. 79-82.

4173 Thermal Characteristics of Silicon Diodes. II. Certain temperature dependent characteristics may be combined to produce a unit with relatively temperature insensitive properties. ***John R. Madigan.*** *Electronic Industries*, v. 19, Jan. 1960, p. 83-87.

4174 Calculating Folded-Unipole Antenna Parameters. When antenna tower heights are restricted for low frequency applications, the folded-unipole antenna offers several advantages; easy methods of calculating system parameters are given. ***George J. Monser.*** *Electronic Industries*, v. 19, Jan. 1960, p. 96 + 6 pages.

4175 Semiconductor Symbols. A complete listing of all symbols, pertinent to semiconductors, which have been adopted as standard by the Institute of Radio Engineers. *Electronic Industries*, v. 19, Jan. 1960, p. 101 + 1 page.

4176 Elements of Solid State Theory. Geometry of the crystalline state, diffraction of radiation by crystals, dynamics of lattice vibrations, co-operative phenomena in solids, one-electron theory of solids, metals, electrons in chemically saturated solids, semiconductors, friction in electron dynamics, Ohm's law, solid cohesion and chemical bonding are discussed. ***Gregory H. Wannier.*** 270 pp. 1959. Cambridge University Press, London. (QC125 W18e)

4177* Radio Transmission by Ionospheric and Tropospheric Scatter. I. Ionospheric Scatter Transmission. II. Long-Range Tropospheric Transmission. The ionospheric transmission is discussed in an introduction, in theories of scattering from the D-region, in experimental observation of propagation characteristics, in a design of ionospheric scatter communication circuits, in fields of application and in factors affecting frequency allocation. The tropospheric transmission is discussed in a summary of principal features, in a review of tropospheric propagation theories, in experimental observation of propagation characteristics, in a design of long-range tropospheric communication circuits, in the field of application and in factors influencing the frequency allocation. *I.R.E. Proceedings*, v. 48, Jan. 1960, p. 4-44.

4178* Crosstalk Due to Finite Limiting of Frequency-Multiplexed Signals. The crosstalk can be calculated with reasonable accuracy by assuming that the input signal is random noise. This assumption allows use of standard analytical techniques to determine the output signal-to-crosstalk ratio in the selected channel as a function of the clipping level. The crosstalk decreases rapidly as the clipping level is raised. ***Charles R. Cahn.*** *I.R.E. Proceedings*, v. 48, Jan. 1960, p. 53-59.

4179* IRE Standards on Methods of Measuring Noise in Linear Twoports, 1959. Discusses the noise factor, the measurement of the average noise factor, the measurement of spot-noise parameters. ***H. A. Haus, et al.*** *I.R.E. Proceedings*, v. 48, Jan. 1960, p. 60-68.

4180* Representation of Noise in Linear Twoports. The general-circuit-parameter representation of a linear two-port with internal sources and the Fourier representations of stationary noise sources are reviewed. The relationship between spectral densities and mean-square fluctuations is given and the noise factor of the linear twoport is expressed in terms of the mean-square fluctuations of the source current and the internal noise sources. ***H. A. Haus, et al.*** *I.R.E. Proceedings*, v. 48, Jan. 1960, p. 69-74.

4181* Multipole Representation for an Equivalent Cardiac Generator. Consists of a collection of multipoles which, if placed at a point in a homogeneous isotropic conductor shaped like the human body, will give rise to the same potential distribution on the surface as that observed on the body itself. ***D. B. Geselowitz.*** *I.R.E. Proceedings*, v. 48, Jan. 1960, p. 74-79.

4182* The Effect of a Cathode Impedance on the Frequency Stability of Linear Oscillators. Cathode impedance changes in a valve may reach 100 ohms during its life-time because of the growth of an interface layer between the oxide coating and the cathode sleeve. In order to reduce the effect of the cathode impedance, the g_m value must be reduced considerably. ***C. T. Kohn.*** *I.R.E. Proceedings*, v. 48, Jan. 1960, p. 80-88.

4183* Multiple Diversity With Nonindependent Fading. Previous analyses of diversity techniques are extended to include the performance of an optimum combiner in the case of nonindependent signal fading fluctuations, for an arbitrary number of diversity branches. The analysis includes the general possibility of correlations among the quadrature components of the various signals. ***J. N. Pierce and S. Stein.*** *I.R.E. Proceedings*, v. 48, Jan. 1960, p. 89-104.

4184 Vector Principles of Inertial Navigation. A vector equation, which is derived from first principles, describes the mechanization of inertial navigation systems for use anywhere in space. A specialized form of this equation applies directly to three-dimensional motion at any speed, any altitude, over an elliptical, rotating earth. ***Alan M. Schneider.*** *IRE Transactions on Aeronautical and Navigational Electronics*, v. ANE-6, no. 3, Sept. 1959, p. 159-178. (TK1 In6.6a Vis.)

4185 Position Estimation Using Only Multiple Simultaneous Range Measurements. Three-dimensional, generalized position-measurement systems are analyzed. In these systems, target position is obtained by trilateration using only range data collected by a group of v stations located in an arbitrary geometry. The method of maximum likelihood is used to obtain a joint estimator for the target coordinates which makes optimal use of the redundant data when the noise is Gaussian. A simple recursion formula for the estimator is obtained for this purpose and is shown to be convergent. ***Herbert L. Groginsky.*** *IRE Transactions on Aeronautical and Navigational Electronics*, v. ANE-6, no. 3, Sept. 1959, p. 178-187. (TK1 In6.6a Vis.)

4186 "C.P.I."—A Crash Position Indicator for Aircraft. A special pulsed transmitter with trickle-charged batteries and an internal antenna is potted in shock-absorbing foam transparent to radio waves and placed inside a special aerofoil. This device, held on the tail of the aircraft, is released automatically upon detection of any abnormal structural disturbance. Then it tumbles away from the aircraft, slows down to a safe landing, and transmits a distress signal. ***D. M. Makow and H. T. Stevinson.*** *IRE Transactions on Aeronautical and Navigational Electronics*, v. ANE-6, no. 3, Sept. 1959, p. 187-200. (TK1 In6.6a Vis.)

4187 High Dielectric Constant Ceramics. A brief review of present knowledge of ferroelectricity in barium titanate is given, since many of the practical problems encountered in the use of high dielectric constant ceramics are rooted in the inherent ferroelectricity of the material. ***Fielding Brown.*** *IRE Transactions on Component Parts*, v. CP-6, no. 4, Dec. 1959, p. 238-251. (TK1 In6.6cp Vis.)

4188 Component-Part Screening Procedures Based on Multiparameter Measurements. The methodology provides an improved semiquantitative basis for the selection and evaluation of screening criteria. It is based on a combination of standard statistical techniques, and is novel only in maintaining a tractable analysis of the over-all problem of screening individual component parts by variables inspection. ***Ralph E. Thomas.*** *IRE Transactions on Component Parts*, v. CP-6, no. 4, Dec. 1959, p. 252-258. (TK1 In6.6cp Vis.)

4189 Some Rating and Application Considerations for Silicon Diodes. The stability criterion depends on the thermal resistance, the reverse characteristic and its change with respect to temperature, the reverse voltage, and the circuit configuration. Derating curves are obtained, based on known variations of the reverse characteristics of Si rectifiers with temperature and voltage. ***H. C. Lin.*** *IRE Transactions on Component Parts*, v. CP-6, no. 4, Dec. 1959, p. 269-273. (TK1 In6.6cp Vis.)

4190 A Time Gate for Echo-Measuring Radar Installations. The detail of design is not presented as being necessarily the ultimate. Rather, the aim is to stress the effectiveness of using filtering and double gate opening, together with mechanical rectification, to produce an effective solution to the problem of linear gating. ***J. Bacon and J. Q. Burgess.*** *IRE Transactions on Instrumentation*, v. I-8, no. 3, Dec. 1959, p. 79-82. (TK1 In6.6i Vis.)

4191 A Transistor Temperature Analysis and Its Application to Differential Amplifiers. The DC diffusion current densities, collector-cut off current density and DC current gain, simplified expression for the collector current density, temperature dependence of the reverse saturation currents, equivalent import drift rate and other problems are discussed. ***Werner Steiger.*** *IRE Transactions on Instrumentation*, v. I-8, no. 3, Dec. 1959, p. 82-91. (TK1 In6.6i Vis.)

4192 Logarithmic Amplifier Design. The analysis of cascaded nonlinear stages, approximate error, bandwidth, circuit design, temperature compensation, lin-log transistor amplifier are discussed. ***S. J. Solms.*** *IRE Transactions on Instrumentation*, v. I-8, no. 3, Dec. 1959, p. 91-96. (TK1 In6.6i Vis.)

4193 Fundamental Limitations of External Noise. Excess noise due to absorbing transmission components is easily evaluated. Noise due to the nonhomogeneous atmosphere is beginning to get some attention. Antenna noise leakage data are inadequate at present. Absolute background measurements cannot be made before antenna sidelobe leakage is carefully evaluated. ***Henry H. Grimm.*** *IRE Transactions on Instrumentation*, v. I-8, no. 3, Dec. 1959, p. 97-103. (TK1 In6.6i Vis.)

4194 Mechanical Design and Manufacture of Microwave Structures. The presentation of design information such as dimensions and tolerances is first discussed. Machining and other fabrication processes are then examined. ***A. F. Harvey.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 4, Oct. 1959, p. 402-422. (TK1 In6.6mt Vis.)

4195 The Dependence of Reflection on Incidence Angle. A lossy dielectric sheet has complex dielectric constant $\epsilon = \epsilon(x)$ and complex permeability $\mu = \mu(x)$, where x is the distance to one interface. The error in the approximation is investigated theoretically and experimentally. A complete set of graphs is included, suitable for design of those absorbers to which the theory applies. ***Raymond Redheffer.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 4, Oct. 1959, p. 423-429. (TK1 In6.6mt Vis.)

4196 Analytical Asymmetry Parameters for Symmetrical Waveguide Junctions. Preferred sets of asymmetry parameters are found which are complete, minimal in number, which go to zero when the junction represented is symmetrical, and which may often be identified with a corresponding structural symmetry defect. The asymmetry parameters are first introduced for general linear junctions, but special attention is given to reciprocal and lossless junctions. ***M. Cohen and W. K. Kahn.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 4, Oct. 1959, p. 430-441. (TK1 In6.6mt Vis.)

4197 Orthogonality Relationships for Waveguides and Cavities With Inhomogeneous Anisotropic Media. A modified reciprocity theorem forms the basis of developments of orthogonality relationships for modes in waveguides and in cavities containing inhomogeneous, anisotropic media. In the lossless case certain of these may be interpreted in terms of power flow and energy storage. The special case of magnetized gyrotropic media is discussed for longitudinal and transverse magnetization. ***Alfred T. Villeneuve.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 4, Oct. 1959, p. 441-446. (TK1 In6.6mt Vis.)

4198 Mismatch Errors in Cascade-Connected Variable Attenuators. The treatment of mismatch errors is extended to cover variable attenuators cascade-connected in a system which is not free from reflections. The method of analysis is applicable to any number of cascaded attenuators, but only the analysis of two and three variable attenuators in cascade is presented. ***G. E. Schafer and A. Y. Rumfelt.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 4, Oct. 1959, p. 447-453. (TK1 In6.6mt Vis.)

4199 A Nonreciprocal, TEM-Mode Structure for Wide-Band Gyrator and Isolator Applications. The theoretical and experimental operation of a novel form of TEM transmission-line network capable of operation over octave bandwidths is described. This network consists, basically, of a parallel arrangement of two conductors and a ferrite rod within a grounded outer shield. The conductors may be connected in a two-port configuration which provides, in the absence of the ferrite rod, complete isolation from zero frequency to the cutoff frequency of the first higher mode. ***E. M. T. Jones, G. L. Matthaei, and S. B. Cohn.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 4, Oct. 1959, p. 453-460. (TK1 In6.6mt Vis.)

4200 High-Power Microwave Rejection Filters Using Higher-Order Modes. In order to obtain filters capable of handling very high power, the use of radial lines and uniform line discontinuities was investigated. Forty-five-degree tapers and uniform lines were used to design a high-power microwave filter capable of handling 700 kw at 15 pounds pressure in a 0.900 by 0.400 ID waveguide. Tuning, in the standard-size waveguide, has no effect on the insertion loss of the higher-mode enlarged waveguide at its resonant frequency. ***Joseph H. Vogelman.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 4, Oct. 1959, p. 461-465. (TK1 In6.6mt Vis.)

4201 A Method for Accurate Design of a Broad-Band Multibranch Waveguide Coupler. A taper is proposed, which, for a 3-db branch coupler, is shown to give much better results in theory and practice than the currently used binomial taper. Also, simple expressions are developed which enable the effects of waveguide junction discontinuities to be adequately corrected, thus allowing a greater accuracy in design to be achieved than was hitherto possible. ***K. G. Patterson.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 4, Oct. 1959, p. 466-473. (TK1 In6.6mt Vis.)

4202* Applications of Photoelectric Cells. Photoelectric devices are now available which will react to visible, infrared or ultraviolet radiation; and they respond in conditions which cannot be observed by human beings, or where an object is not suitable for mechanical or manual handling. ***F. A. Benson.*** *Institution of Electrical Engineers, Journal*, v. 5, no. 59, Nov. 1959, p. 630-636.

4203* The Spectral Density of the A.M. Noise in Reflex Klystrons. The measurements show that the noise density is, with great accuracy, constant in the actual range. This agrees with the theory, which is based on a treatment by Knipp. ***H. Häggblom.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. B, no. 30, Nov. 1959, p. 497-500.

4204* High-Quality Microphones. Reviews present-day practice in the design and operation of high-grade microphones used for broadcasting, sound reinforcement, sound recording, acoustical measurements, etc. General requirements, basic operating principles and design details are given for typical microphones of various types. They are classified acoustically into omnidirectional and directional categories for the purposes of discussion and analysis. ***M. L. Gayford.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. B, no. 30, Nov. 1959, p. 501-516.

4205* An Electron-Trajectory Tracer for Use With the Resistance Network Analogue. Construction details are given, and results for two typical electrostatic lenses are shown and compared with results obtained experimentally. Methods for improving accuracy and speed of operation are outlined. ***M. E. Haine and J. Vine.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. B, no. 30, Nov. 1959, p. 517-527.

4206* High-Power Television Transmitters for Bands IV and V. To increase the number of channels available for television broadcasting, it is now becoming increasingly necessary in several countries to utilize the ultra-high-frequency bands (Band IV, 470-585 Mc/s, and Band V, 610-960 Mc/s). The choice of a high-gain klystron output amplifier for a 10kW transmitter enables a relatively low-power modulated amplifier to be used in the penultimate stage. ***T. S. Robson and T. M. J. Jaskolski.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. B, no. 30, Nov. 1959, p. 528-540.

4207* The Field Strengths Required for the Reception of Television in Bands I, III, IV and V. Examines the factors involved in the reception of 405-line television signals in the 4 frequency bands assigned to television broadcasting in Europe. After consideration of the receiving-installation characteristics appropriate to the various bands, and the statistical variation of field strength with aerial location over the range of frequencies involved, a basis for the specification of the median field strength defining the nominal limit of the service area of a television station is described. ***G. F. Swann.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. B, no. 30, Nov. 1959, p. 541-547.

4208* Further Studies of the Deviation of Low- and Medium-Frequency Ground Waves at a Coast-Line. In both cases the transmitters were located at sea and the directional measurements taken at numerous sites on land. A deviation due solely to the change in ground conductivity at the boundary and of the magnitude given by theory is small compared with the larger random directional errors which are attributed to ground irregularities, surface obstructions and other causes. ***B. G. Pressey, G. E. Ashwell, and R. Roberts.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. B, no. 30, Nov. 1959, p. 548-554.

4209* A Multiple-Direction Universally-Steerable Aerial System for H.F. Operation. Presents principles underlying the current development of a high-frequency directional aerial system which can be steered in both azimuth and elevation. The system comprises a number of omnidirectional unit aerials whose outputs may be brought approximately into phase with each other for any desired combination of frequency and direction by means of direction-control equipment which is basically a high-speed computer. ***D. W. Morris and G. Mitchell.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. B, no. 30, Nov. 1959, p. 555-558.

4210* A Ferrite Boundary-Value Problem in a Rectangular Waveguide. Using a published formulation of the equations for the reflection of an electromagnetic wave from a transversely magnetized ferrite block in a rectangular waveguide, a solution in closed form for the integral equation involved is given. A detailed discussion of this solution in a certain range of the gyromagnetic parameter follows. ***L. Lewin.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. B, no. 30, Nov. 1959, p. 559-563.

4211 Linear Network Analysis. Fundamental concepts, loop and node systems of equations, matrix algebra and elementary topology, general network analysis, network theorems and steady-state response, integral solutions and other problems are discussed. ***Sundaram Seshu and Norman Balabanian.*** 571 pp. 1959. John Wiley & Sons, New York. (TK3226 Se71L)

4212* The MIDOT Missile-Tracking System. More than 50 rocket trajectories have been tracked in both single and multiple configuratons. Nine trajectories are the maximum number that have been tracked simultaneously. The MIDOT system has produced records worthy of reduction on 36 trajectories. ***T. L. Pace and T. V. Crawley.*** *Military Systems Design*, v. 3, no. 6, Nov.-Dec. 1959, p. 298-299.

4213 A Drift Monitoring System and a Rapid Calibrating Technique for the Capacitive Wave Profile Recorder. A voltage, simulating the at-rest water level, is set up on a potentiometer and is used as a reference for monitoring drift in the system. For calibration, a remotely-controlled motor positions the probe at either of two preset limits approximating the maximum and the minimum height of the waves to be measured. ***R. J. Harron.*** *National Research Council of Canada, Mechanical Engineering Report* MI-818A, Mar. 1959, 15 pp. (TJ1 N21.5m Contin.)

4214 Reciprocity Theorems and Plane Surface Waves. Scattering by dielectric and metal objects, surface waves on plane dielectric sheets and sandwiches, and excitation of surface waves on plane dielectric sheets are discussed. ***J. H. Richmond.*** *Ohio State University, Engineering Experiment Station Bulletin* 176, July 1959, 116 pp. (TA21 03b Vis.)

4215 A Range of Pulsed Magnetrons for Centimetre and Millimetre Waves. An experimental range of magnetrons is described for wavelengths of 32, 12, 8 and 4 mm, and delivering peak outputs of 1100, 70, 80, and 40 kW, respectively. It is found that the wavelength is proportional, and the requisite magnetic field inversely proportional, to the linear dimensions and that the same power is generated for the same anode voltage and current. Life tests on a 32 mm, a 12 mm, and an 8 mm magnetron were terminated after 238, 700, and 1488 hours, respectively; the power outputs had dropped in that time by about 15%. ***J. Verweel and G. H. Plantinga.*** *Philips Technical Review*, v. 21, no. 1, Dec. 1959, p. 1-9.

4216 The Resistance Network, a Simple and Accurate Aid to the Solution of Potential Problems. The resistance network has won a place beside the electrolytic tank as an

aid to the solution of Laplace's equation for given boundary conditions. Two kinds of network have practical importance. The first is useful for solving two-dimensional problems, the second for solving three-dimensional problems where rotational symmetry exists. An example of the employment of a network for rotationally-symmetric three-dimensional problems is given in which curves are derived which allow the cut-off voltage and maximum cathode loading of tetrode electron guns to be determined. ***J. C. Francken.*** *Philips Technical Review*, v. 21, no. 1, Dec. 1959, p. 10-23.

4217 Vector-Electrocardiography. The electrical action of a contracting muscle fibre is equivalent to that of a dipole and can be represented by a vector. The same applies to an entire muscle, such as the heart, insofar as the electrical phenomena are observed at a large distance from the source. During the heart beat the heart vector changes in magnitude and direction. Successive recordings are made of the frontal, horizontal, and sagittal projections of the vectorcardiogram. ***G. C. E. Burger and G. Klein.*** *Philips Technical Review*, v. 21, no. 1, Dec. 1959, p. 24-37.

4218 Principles of Noise. Problems of Fourier Series and integrals, probability, stationary random processes, physical sources of noise, equivalent noise generators, noise factor, the measurement of a direct voltage, the Gaussian random process, the detection of alternating waveforms, target noise are discussed. ***J. J. Freeman.*** 299 pp. 1958. John Wiley & Sons, New York. (TK5981 F87p)

4219* Path Antenna Gain in an Exponential Atmosphere. The method used here takes into account for the first time the exponential decrease of the gradient of refractive index with height, and a scattering cross section inversely proportional to the fifth power of the scattering angle. Results are given for all combinations of beamwidths and path geometry, assuming that symmetrical beams are used on both ends of the path and that atmospheric turbulence is isotropic. ***W. J. Hartman and R. E. Wilkerson.*** *U. S. National Bureau of Standards Journal of Research, Section D, Radio Propagation*, v. 63D, no. 3, Nov.-Dec. 1959, p. 273-286.

4220* Pattern Synthesis for Slotted-Cylinder Antennas. A procedure for synthesizing a given radiation pattern is developed with particular attention being paid to a Tchebyscheff-type pattern. Specifying the side lobe level and the width of the main beam, the required source distributions are computed for a number of cases. The effect of using a finite number of slot elements to approximate the continuous source distribution is also considered. ***James R. Wait and James Householder.*** *U. S. National Bureau of Standards Journal of Research, Section D, Radio Propagation*, v. 63D, no. 3, Nov.-Dec. 1959, p. 303-313.

See also: **3752** (radio guidance of missiles); **3754** (Doppler-inertial guidance of missiles); **4437** (Russian test equipment); **4766** (ferrites).

ENGINEERING ECONOMICS

4221 A Comparison of National Output and Productivity of the United Kingdom and the United States. The object of this study is to provide statistical comparisons of the national products and productivity per worker of the United Kingdom and the United States, not only for the two economies in the aggregate, but for the various industries that contribute to total output. ***Deborah Paige and Gottfried Bombach.*** 245 pp. 1959. The Organisation for European Economic Co-Operation, Paris. (HC106.5 P15c)

4222 Facts and Figures (on the Gas Industry). Sales figures through March, 1959. *American Gas Association Monthly*, v. 41, no. 5, May 1959, p. 15 + 1 page.

4223* The Commercial Development of an Aerosol Product. Gives criteria for successful marketing of aerosol products. ***Winston H. Reed.*** *American Perfumer and Aromatics*, v. 74, Dec. 1959, p. 27-29.

4224* Problems in Estimating Federal Government Expenditures. Forecasting Federal expenditures is still a wide open field in which statisticians should be able to develop techniques to help improve on the many horse-back judgments which are now made by program experts and political seers. ***Samuel M. Cohn.*** *American Statistical Association, Journal*, v. 54, no. 288, Dec. 1959, p. 717-729.

4225* National Economic Growth Accomplishments and Prospects. Considers the questions: How fast has our economy grown in the past? How fast may we reasonably expect it to grow in the next decade? And what kinds of public and private policies should we pursue to realize our potential for growth? ***Raymond J. Saulnier.*** *Business Horizons*, v. 2, no. 4, Winter 1959, p. 56-60.

4226* An Approach to Successful Marketing Planning. Claims that formal marketing planning as it is practiced today in many companies probably represents the biggest single waste of time and money in the entire corporate realm. ***Andrall E. Pearson.*** *Business Horizons*, v. 2, no. 4, Winter 1959, p. 74-82.

4227 C&EN Reviews and Previews. The Chemical World 1959/1960. A comprehensive survey. *Chemical and Engineering News*, v. 38, no. 1, Jan. 4, 1960, p. 45-76.

4228 Chemical Spending: Upturn in 1960. Record chemical sales this year trimmed most of the fat from 1958's unwieldy excess capacity. Prudent new-plant spending will keep it well proportioned. ***Alfred Litwak.*** *Chemical Engineering*, v. 66, Dec. 28, 1959, p. 36 + 1 page.

4229 Consider All Factors in a Rational Approach to Plant Layout. Covers particular methods to be used in actual plant layout. ***Donald Thompson.*** *Chemical Engineering*, v. 66, Dec. 28, 1959, p. 73-76.

4230 Economic Control of Interconnected Systems. Discusses control analysis and computer control of power systems, economic operation of a combined steam and hydroelectric power system, interconnected systems energy accounting, analysis of losses in interconnected areas and other problems. ***Leon K. Kirchmayer.*** 207 pp. 1959. John Wiley & Sons, New York. (TK441 K63e)

4231* The Problem of Government Ownership of the Electric Light and Power Business in the United States. ***Edwin Vennard.*** *Edison Electric Institute Bulletin*, v. 27, Dec. 1959, p. 399 + 6 pages.

4232* Electric Utilities in 1960: 101 Ways to Improve Plans, Management, Performance. This is EL & P's "look-ahead" by 15 industry leaders. *Electric Light and Power*, v. 38, no. 1, Jan. 1, 1960, p. 33-44.

4233* The Decline and Rise of Soviet Economic Science. There can be little doubt that in the years to come the introduction of scientific planning techniques will increase the over-all productivity of the Soviet economy, just as the adoption of new methods of scientific management by our own large corporations has raised the efficiency of their internal operations. Whether the increased productivity will be used to accelerate still further the high rate of their economic growth, to step up military preparations or, as the free world should hope, to raise their standard of living, one cannot predict. ***Wassily Leontief.*** *Foreign Affairs*, v. 38, no. 2, Jan. 1960, p. 261-272.

4234 Industrial Design in the United States. Contains the observations and recommendations of a European Mission which visited the United States in Oct.-Nov. 1955, under the auspices of the OEEC and the American International Co-operation Administration. 140 pp. 1959. European Productivity Agency, Paris. (HD69.I5 Or4i)

4235* How to Increase Recognition of an 'Anonymous' Product. Because of the standardized nature of its product, Alpha Portland Cement Co. found it could not build a brand preference. Instead, the company built company preference, through a program of supplying helpful sales and business hints to its customers. Here are the details of Alpha's program. ***W. Robert Ingram.*** *Industrial Marketing*, v. 45, Jan. 1960, p. 57-58.

4236* Is Marketing Becoming More Important to Industry? Three top industrial executives give their views on this question. ***Courtland Gross.*** *Industrial Marketing*, v. 45, Jan. 1960, p. 111-112.

4237 "Soaring '60's": What Business Can Expect in Next Decade. The economy will pass the $500-billion mark late this year. And it may hit $700-billion by 1970. But progress will be marked by changing market patterns. A studied forecast for the next ten years. ***H. T. Hovde.*** *Iron Age*, v. 185, no. 1, Jan. 7, 1960, p. 293-300.

4238 The Influence of Oxygen on World Steelmaking. Although considerable advantages have already been obtained from the use of oxygen in ferrous metallurgy, it is quite clear that much work remains to be done. ***D. W. N. Pitts and J. L. Harrison.*** *Iron & Steel*, v. 32, no. 13, Dec. 1959, p. 567-571.

4239* Incentive Wage Practice for Restricted Work. Discusses an incentive program for manual work restricted by the accompaniment of machine. ***Maximo Halty.*** *Journal of Industrial Engineering*, v. 10, no. 6, Nov.-Dec. 1959, p. 457-460.

4240 Some Do's and Don'ts for Test Marketing. ***John E. Flynn.*** *Management Review*, v. 49, Jan. 1960, p. 38-41.

4241 Needed—A Realistic Plan for Water Allocation. The need for regulation of the water resources of the U. S. is becoming more urgent than ever before. ***Eli Schwartz.*** *Management Review*, v. 49, Jan. 1960, p. 57-59.

4242* Decade of the Big Shakeups. The marketing revolution has caused sweeping changes in many sales organizations. And there'll be more. ***Frank Breese.*** *National Petroleum News*, v. 52, no. 1, Jan. 1960, p. 65 + 4 pages.

4243 Annual Report on the Nitrogen Industry. *Nitrogen*, no. 4, Dec. 1959, p. 14-17.

4244 Resources for the Future. Annual Report for the Year Ending September 30, 1959. This report discusses the accomplishments of 1959 and of the first five years of the organization in its goal of wise use of all natural resources. 92 pp. Dec. 1959. Resources for the Future, Inc. Washington, D. C. (pamphlet file)

4245 Metalworking Facts and Figures. Twelfth annual edition of data on production, prices, etc. *Steel*, v. 146, Jan. 4, 1960, p. S1-S48.

4246 Production Efficiency—How to Get It. Shows that America's place as the world's leading industrial nation can be maintained only by elimination of wasteful and archaic elements such as strikes, featherbedding, and unrealistic depreciation laws. In addition, close attention must be paid to capital goods replacement. *Steel*, v. 146, Jan. 4, 1960, p. 93-96.

4247 Can Scrap Make Comeback? The scrap industry expects 1960 to be a good year, but it continues to be concerned about the downtrend in purchased scrap brought about by technological advances in steelmaking. *Steel*, v. 146, Jan. 11, 1960, p. 41.

4248 The Compilation of Manufacturing Statistics. Augments the information available on the programs and activities leading up to and including the publication of industrial statistics. ***Frank A. Hanna.*** 233 pp. 1959. U. S. Department of Commerce, Washington, D. C. (HA29 H19c)

See also: **4285** (new coking methods); **4365** (costs at Lincoln Tungsten Mine); **4366** (mining costs at Piokee Mining Unit); **4372** (drilling costs reduction); **4546** (foundry cost control).

FLUID MECHANICS

4249 Void Fractions in Two-Phase Flow. Concerns the fraction of the flow cross-sectional area occupied by the gas phase. ***H. S. Isbin, H. A. Rodriguez, H. C. Larson, and B. D. Pattie.*** *A.I.Ch.E. Journal*, v. 5, no. 4, Dec. 1959, p. 427-432.

4250 Transition From Laminar to Turbulent Flow in Pipes. ***N. W. Ryan and M. M. Johnson.*** *A.I.Ch.E. Journal*, v. 5, no. 4, Dec. 1959, p. 433-435.

4251 Vaporization of Superheated Drops in Liquids. ***G. R. Moore.*** *A.I.Ch.E. Journal*, v. 5, no. 4, Dec. 1959, p. 458-466.

4252 An Experimental Study of Diffusion-Controlled Reactions in a Laminar Boundary Layer. Reviews the problem of a rapid second-order reaction in the incompressible laminar boundary layer on a flat plate. ***Mitchell Litt and S. K. Friedlander.*** *A.I.Ch.E. Journal*, v. 5, no. 4, Dec. 1959, p. 483-485.

4253* The Influence of Cavitation on Hydrofoil Craft Design. ***M. C. Eames.*** *Canadian Aeornautical Journal*, v. 6, no. 1, Jan. 1960, p. 16-31.

4254 Heat Transfer to Moving Fluids. Conduction and convection describe mechanics of heat transfer to moving fluids; but empirical correlations are necessary to express over-all heat transfer coefficients. ***Jesse Coates and Bernard S. Pressburg.*** *Chemical Engineering*, v. 66, Dec. 28, 1959, p. 67-72.

4255* The Hydrodynamics of Flow Between Horizontal Concentric Cylinders. II. Generalized Criteria and Correlation of Heat Transfer Data. The neutral stability criteria for the generalized case of flow due to circumferential pumping and rotation of the inner cylinder are reviewed. ***A. H. Nissan and F. C. Haas.*** *Chemical Engineering Science*, v. 11, no. 3, Nov. 1959, p. 207-211.

4256* Heat-Transfer and Pressure Drop on Undeveloped Laminar Flow in Pipes and in Smooth Slits. The well-known Graetz-Nusselt solution for heat-transfer in laminar pipe flow presumes developed velocity profiles. At the beginning of a heating or a cooling cycle, the velocity profile is not yet developed, and the hydrodynamic and the thermal flow overlap. This problem was investigated on the assumption of constant values of the substances. (*In German.*) Wärmeübergang und Druckabfall bei nicht ausgebildeter Laminarströmung in Rohren und in ebenen Spalten. ***Karl Stephan.*** *Chimie-Ingenieur-Technik*, v. 31, Jan. 1960, p. 773-778.

4257* Encyclopedia of Physics. I. Fluid Dynamics. Principles of fluid mechanics; boundary layers; turbulent flow. (*In German.*) Handbuch der Physik. I. Strömungsmechanik. ***S. Flügge and C. Truesdell, editors.*** v. 8. 471 pp. 1959. Springer-Verlag, Berlin. (QC21 G27h3)

4258 Visualisation of Plastic Flow Patterns. ***R. A. Collacott.*** *Engineering*, v. 188, Dec. 18, 1959, p. 646-647.

4259 Hypersonic Flow Theory. Small-disturbance theory; Newtonian theory; the theory of thin shock layers; viscous flows; and viscous interactions. ***Wallace D. Hayes and Ronald F. Probstein.*** 464 pp. v. V. 1959. Academic Press, New York. (TL573 H32h)

4260* General Theory on Steady Behaviours of Open Channel Flows by Means of One Dimensional Procedures of Analysis. ***Yoshiaki Iwasa.*** *Kyoto University, Memoirs of the Faculty of Engineering*, v. 21, pt. 4, Oct. 1959, p. 348-366.

4261 Geometry of the Structure of Monatomic Liquids. ***J. D. Bernal.*** *Nature*, v. 185, Jan. 9, 1960, p. 68-70.

4262* An Application of the Entropy-Production Principle to Fluid Mechanics Problems. ***Lit S. Han.*** *News in Engineering at Ohio State University*, v. 31, no. 4, Nov. 1959, p. 17-18.

4263 An Absolute Determination of the Viscosity of Eleven Gases Over a Range of Pressures. Based on a new theory of the oscillating-disk viscometer which includes the effect of the finite radius as well as that of its cylindrical circumference. ***J. Kestin and W. Leidenfrost.*** *Physica*, v. 25, Nov. 1959, p. 1033-1062.

4264 Some Properties and Problems of the Liquid State. Methods of studying liquid structure, by statistical mechanical theories assuming an interaction function, by direct geometrical methods, and by using "cell theories" are described. ***N. E. Cusack and J. E. Enderby.*** *Research*, v. 12, Dec. 1959, p. 475-481.

4265* **The Boiling of Liquids.** Mechanism of boiling; film and transition boiling; nuclear boiling; and local boiling. ***R. C. L. Bosworth.*** *Reviews of Pure and Applied Chemistry,* v. 9, no. 3, Sept. 1959, p. 213-223.

4266 **The Dynamics of Thin Sheets of Fluid. I. Water Bells. II. Waves on Fluid Sheets. III. Disintegration of Fluid Sheets.** Solution of equations representing the shape of an axially symmetric sheet of fluid is given. The shapes so calculated are compared with photographs of a "water bell" produced by placing a plane or conical obstruction in the center of a jet of water. Shows two kinds of capillary waves; antisymmetrical waves which are nondispersive, and symmetric waves which are highly dispersive. ***Geoffrey Taylor.*** *Royal Society, Proceedings,* v. 253, ser. A, Dec. 15, 1959, p. 289-321 + 9 plates.

4267 **The Magnetodynamics of Conducting Fluids.** Electromagnetic theory and fluid mechanics are combined from the continuum point of view in order to discuss the physical concepts and obtain results relating to the influence of magnetic fields on wave propagation, shock-tube flows, subsonic and supersonic nozzle flows, and viscous boundary layers. ***Daniel Bershader, editor.*** 145 pp. 1959. Stanford University Press, Stanford, California. (Qc809.M3 B46m)

4268* **Impulsive Rotatory Motion of a Circular Disk in a Viscous Fluid.** ***Ram Prakash Kanwal.*** *Zeitschrift für Angewandte Mathematik und Physik,* v. 10, no. 6, 1959, p. 552-557.

FOOD TECHNOLOGY

4269* **Today's Needs in Food Service Equipment.** Suggests equipment that is portable, wheeled, mobile. Heavy-duty equipment would have heavy swivel casters on the rear legs and rigid casters, with a brace, on the front. Equipment would be modular, constructed to standardized measurements. It would be designed at a height comfortable to the workers. Cables, service connections, and motors would be enclosed in liquid-proof, grease-tight, insect-tight, easy-to-clean units. Metals would be non-corrosive and easily cleaned. Corners would be coved. Portable equipment would have clean-out panels; built-in equipment would have removable panels. There would be 6 to 8 in. free floor space beneath equipment, a minimum of legs, and 8 to 12 in. between equipment and walls. ***Edith A. Jones.*** *American Dietetic Association, Journal,* v. 36, Feb. 1960, p. 114-117.

4270* **Chemistry and Meat Curing.** ***H. C. Hornsey.*** *Food Manufacture,* v. 34, Dec. 1959, p. 467 + 3 pages.

4271* **Lye-Pressure Steam Peeling of Potatoes and Other Products.** As surface areas increase, peel loss is decreased. Five per cent lye followed by 45 seconds at 75 p.s.i.g. steam resulted in good peeling, the peel loss being 14.6%. Addition of a wetting agent to 5% lye, followed by steam, produced good results with high yield. Cost analyses on three peeling methods indicated lye plus steam is the most economical method of peeling. ***Harold W. Adams, Frank D. Hickey, and Miles J. Willard, Jr.*** *Food Technology,* v. 14, Jan. 1960, p. 1-3.

4272* **Radiation Preservation of Milk. X. Studies on the Radiation Induced Gelation of Concentrated Milk. Methods, and Effect of Some Additives.** ***J. E. Hoff, J. Sunyach, B. E. Proctor, and S. A. Goldblith.*** *Food Technology,* v. 14, Jan. 1960, p. 24-26.

4273* **Pregelatinized Starches for the Food Processor.** ***Leonard M. Waldt.*** *Food Technology,* v. 14, Jan. 1960, p. 50-53.

4274* **Characteristics of Corn Starch and Starch Derivatives as Affected by Freezing, Storage and Thawing. I. Simple Systems.** Freezing starch slurries instantaneously by direct immersion in liquid N made it possible to eliminate sponge formation from samples of pregelatinized regular corn starch and the curdled appearance from waxy maize slurries. After storage at zero F for one week, samples frozen by this method gave no indication of retrogradation. ***James J. Albrecht, A. I. Nelson, and M. P. Steinberg.*** *Food Technology,* v. 14, Jan. 1960, p. 57-63.

4275 **Footnote to Freedom From Want.** A quantitative appraisal of the food and population problem on a world-wide basis. ***Oswin W. Willcox.*** *Journal of Agricultural and Food Chemistry,* v. 7, Dec. 1959, p. 813-822.

4276* **Modifications of Diets Responsible for Induction of Coronary Thromboses and Myocardial Infarcts in Rats.** ***Wilbur A. Thomas, W. Stanley Hartroft, and Robert M. O'Neal.*** *Journal of Nutrition,* v. 69, no. 4, Dec. 1959, p. 325-331 + 3 plates.

4277* **The Absorbability of Stearic Acid When Fed as a Simple or Mixed Triglyceride.** ***F. H. Mattson.*** *Journal of Nutrition,* v. 69, no. 4, Dec. 1959, p. 338-342.

4278* **All-Vegetable Protein Mixtures for Human Feeding. I. Use of Rats and Baby Chicks for Evaluating Corn-Based Vegetable Mixtures.** Corn-based, simplified all-vegetable protein mixtures containing corn, sesame, cottonseed, torula yeast, and green leaf meal were evaluated by amino acid analysis and by growth and feed efficiency studies using both rats and baby chicks. ***R. L. Squibb, M. K. Wyld, N. S. Scrimshaw, and R. Bressani.*** *Journal of Nutrition,* v. 69, no. 4, Dec. 1959, p. 343-350.

4279* **All-Vegetable Protein Mixtures for Human Feeding. II. The Nutritive Value of Corn, Sorghum, Rice and Buckwheat Substituted for Lime-Treated Corn in Incap Vegetable Mixture Eight.** ***R. Bressani, A. Aguirre, and Nevin S. Scrimshaw.*** *Journal of Nutrition,* v. 69, no. 4, Dec. 1959, p. 351-355.

4280* **Relation of Dietary Fat and Supplementary Riboflavin to Tissue Levels of Cholesterol, Riboflavin and Total Lipids in the Rat.** Rats fed a ration containing 20% of fat and varying levels of riboflavin had a higher concentration of cholesterol in liver than did corresponding animals fed a ration containing 5% of fat. The level of dietary fat had no effect on serum cholesterol which increased with increased riboflavin intake at both fat levels. ***Inez Harrill, Anne M. Kylen, Adelia Weis, and Elizabeth Dyar.*** *Journal of Nutrition,* v. 69, no. 4, Dec. 1959, p. 356-364.

4281* **Effect of Dietary Fats and Carbohydrates on Digestibility of Nitrogen and Energy Supply, and on Growth, Body Composition and Serum Cholesterol of Rats.** ***Mary W. Marshall, Hazel E. Hilderbrand, Jacqueline L. Dupont, and Madelyn Womack.*** *Journal of Nutrition,* v. 69, no. 4, Dec. 1959, p. 371-382.

4282* **Effects of Essential Fatty Acids, Inositol, Vitamin B_{12} and Hydrolyzed Glucose-Cyclo-Acetoacetate on Blood Coagulation Factors in Rabbits Exhibiting Hyperlipemia Induced by Feeding Saturated Fat.** Prolonged feeding of a diet containing 20% of highly saturated fat to rabbits and which leads to experimental atherosclerosis has been found to shorten the coagulation factors (bleeding time, coagulation time, and prothrombin time), as well as to increase the liver fat and number of blood platelets, and to increase ester cholesterol in blood and liver and heart tissues. The administration of essential fatty acids (linoleic and linolenic), inositol, vitamin B_{12} and hydrolyzed GCA was again shown to counteract such shortening of coagulation factors. ***M. C. Nath and A. Saikia.*** *Journal of Nutrition,* v. 69, no. 4, Dec. 1959, p. 403-411.

4283* **Adaptation of Enzymatic Visceration and Scaling for the Fish Industry.** The viscera and scales of fish are simultaneously removed without cutting and scraping. The procedure is a regulated, preferential, enzymatic digestion. The natural enzymes of the fish and those of a special enzyme solution work together to give visceration and scaling. The discovery has the prospect of reducing man-hours where fish are processed for food, and is expected to be of considerable importance in the canning of sardines, mackerel, and other small fish. ***W. W. Meinke.*** *Texas Engineering Experiment Station News,* v. 10, no. 4, Dec. 1959, p. 3-6.

See also: **4835** (soil chemistry of cesium 137).

FUELS AND COMBUSTION

4284 Effect of Ambient and Fuel Pressure on Spray Drop Size. Curves are presented which show the spatial variation in fuel flow rate, spray-stream velocity, and drop size for diesel fuel. ***S. M. De Corso.*** *ASME, Transactions, Series A, Journal of Engineering for Power*, v. 82, no. 1, Jan. 1960, p. 10-18.

4285 New Coking Methods Shorten West's Raw Material Supply Lines. *Chemical Week*, v. 86, no. 3, Jan. 16, 1960, p. 40-42.

4286* Studies of Autoignition and Knock With Propane as an Engine Fuel. Special problems of high-temperature operation are dealt with in relation to knock-limited performance and the ability of the engine to operate using weak mixtures. ***N. P. W. Moore and B. N. Roy.*** *Combustion and Flame*, v. 3, no. 4, Dec. 1959, p. 421-435.

4287* Notes on Gaseous Nitric Acid — Hydrocarbon Flames. Substitution of Ar for N as shielding fluid about nitric acid-hydrocarbon flames does not change the spectra involving CN and NH radicals. Color photographs show qualitative differences between low- and high-temperature inlet gases. ***J. Mertens and R. L. Potter.*** *Combustion and Flame*, v. 3, no. 4, Dec. 1959, p. 525-527 + 2 plates.

4288* Theory of the Burning of Monopropellant Droplets. ***F. A. Williams.*** *Combustion and Flame*, v. 3, no. 4, Dec. 1959, p. 529-544.

4289 Explosions, Detonations, Flammability and Ignition. Pts. I-II. Reviews current state of knowledge of explosions and their prevention, of detonation, flammability, and ignition from entirely different but complementary viewpoints, the one analytical and the other semi-empirical and practical. Pt. I. ***S. S. Penner.*** Pt. II. ***B. P. Mullins.*** 287 pp. 1959. Pergamon Press, New York. (QD516 P38e)

4290* Further Studies on the Mechanism of the Oxidation of Coal. ***B. K. Mazumdar, et al.*** *Fuel*, v. 38, no. 4, Oct. 1959, p. 469-482.

4291* Some Observations on the Specific Surface of Coals. ***S. J. Gregg and M. I. Pope.*** *Fuel*, v. 38, no. 4, Oct. 1959, p. 501-505.

4292 Flame Traps for Use With Town Gas/Air Mixtures. ***P. A. Cubbage.*** *Gas Council, Research Communication No.* 63, 62 pp. (TP700 G21.2r Vis.)

4293 The Removal of Carbon Monoxide From Fuel Gases. Can be removed from town gas by catalytic reaction with H to give hydrocarbons, by absorption in cuprous salt solutions or by reaction with steam on a catalyst to give CO_2 and H. ***G. S. Cribb and J. D. F. Marsh.*** *Gas Council, Research Communication No.* 66, 32 pp. (TP700 G21.2r Vis.)

4294 The Effect of Nuclear Radiation of Jet Fuels. Preliminary studies on fuels available at this time. ***A. C. Nixon, R. E. Thorpe, and H. B. Minor.*** *Industrial and Engineering Chemistry*, v. 52, Jan. 1960, p. 47-50.

4295 Combustion of Cyanogen With Endothermic Oxides of Nitrogen. ***Charles S. Stokes, Robert P. M. Werner, William F. R. Smith, and Joseph A. Cahill.*** *Industrial and Engineering Chemistry*, v. 52, Jan. 1960, p. 75-78.

4296* The Swelling and Contraction of Briquettes During Carbonization. Briquettes of low-rank coals expand when heated through the temperature range from 20 to 380 C. In binderless briquettes this expansion is shown to result mainly from thermal relief of stresses introduced during briquetting. ***A. D. Dainton and W. G. Kaye.*** *Institute of Fuel, Journal*, v. 32, Dec. 1959, p. 571-578 + 2 plates.

4297* The Reaction of Gaseous Sulphur Dioxide With a Low-Rank Coal. ***R. G. Partington and R. Sidebottom.*** *Institute of Fuel, Journal*, v. 32, Dec. 1959, p. 597-601.

4298 Flames and Furnaces. Laws of heat transfer. ***M. W. Thring.*** *Iron & Steel*, v. 32, no. 13, Dec. 1959, p. 572-575.

4299 Temple Studies High Temperature Flames. Aerodynamic heating over 4000 K created to determine effects and nature of combustion processes. ***William L. Doyle.*** *Missiles and Rockets*, v. 5, no. 51, Dec. 14, 1959, p. 17-18.

4300* New Knock-Test Method Could Save Millions in Finding Octane Numbers. ***G. A. MacDonald.*** *Oil and Gas Journal*, v. 58, no. 2, Jan. 11, 1960, p. 89-94.

4301 Figure Octanes of Blends This Way. Information needed is the paraffin plus naphthene concentration and the octane rating of each component to figure blend octanes. ***L. C. Doelp and E. R. Westfield.*** *Petroleum Refiner*, v. 39, Jan. 1960, p. 181-184.

4302 Expanding Properties of American Coals Tested in a Sole-Heated Oven. ***J. E. Wilson, B. W. Naugle, and D. E. Wolfson.*** *U. S. Bureau of Mines Report of Investigations* 5537, 1959, 29 pp. (TN21 Un3r Vis.)

4303* Producing Equipment for Natural Gas Wells. A collection of papers on conventional separators, mechanical low-temperature separation units, long-cycle dry desiccant dehydrators, and $CaCl_2$ dehydrators. ***J. B. Fowler, et al.*** *World Oil*, v. 150, Jan. 1960, p. 81-110.

4304* Reverse *in situ* Combustion. Investigates the *in situ* combustion of crude oil, that is the "burning in place" of oil which has saturated a porous rock formation. This phenomenon is of interest to the petroleum industry as a thermal-recovery method for residual oil in a reservoir. ***Robert P. Gilbert.*** *Zeitschrift für Angewandte Mathematik und Physik*, v. 10, no. 6, 1959, p. 544-551.

See also: **4393** (measurement of turbulence intensity); **4394** (burning velocities of H-air and hydrocarbon-air mixtures); **4746** (dewatering stoker coal).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

4305* Possibility of Hydrocarbon Accumulations Along Northern Flank of Marietta Syncline, Love County, Oklahoma. ***C. C. Reeves, Jr. and J. Russell Mount.*** *American Association of Petroleum Geologists, Bulletin*, v. 44, Jan. 1960, p. 72-82.

4306* The Distribution of Mineral Dates in Time and Space. Most igneous and metamorphic mineral dates indicate times of rock cooling, the terminal events of crustal adjustment. Accordingly, the distribution of mineral dates in time indicates the periodicity of such events, and the distribution in space indicates the geometry of their occurrence. ***Gordon Gastil.*** *American Journal of Science*, v. 258, no. 1, Jan. 1960, p. 1-35.

4307 Atmospheric Diffusion and Air Pollution. These proceedings of a symposium held at Oxford, England, Aug. 24-29, 1958, comprise advances in geophysics. ***F. N. Frenkiel and P. A. Sheppard, editors.*** v. VI. 471 pp. 1959. Academic Press, New York. (QC806 Ad95 Vis.)

4308* Research and Minerals Resources. Fundamental and specialized research provides new aids and methods to the problem of finding ore deposits, but in light of present trends there is need to expand research. ***Harold M. Bannerman.*** *Canadian Mining Journal*, v. 81, Jan. 1960, p. 45-49.

4309 Corrosion Control Practices in the Wilmington Water Flood Operation. Data are given on the method of well completion, volume of water injected, types of pumps and lines used in the Wilmington (Cal.) Water Flood Operation. ***C. H. Jones, Jr.*** *Corrosion*, v. 15, Dec. 1959, p. 99 + 2 pages.

4310* The Origin of the Solar System. Choice between rival hypotheses about the origin of the Solar System is hindered by the fact that there is only one available for study, for it is not possible to distinguish significant features which

demand explanation from those which are accidental and do not. ***Michael W. Ovenden.*** *Discovery,* v. 21, Jan. 1960, p. 2-5.

4311* Use of Percussion Tools With Air and Gas. Laboratory testing and field testing in 12 wells has resulted in the development of the hammer drill tool using air or gas-operated percussion hammer to obtain drilling rate increases of two to three times that of air rotary drilling. ***Walter E. Liljestrand.*** *Drilling Contractor,* v. 16, no. 1, Dec.-Jan. 1959-60, p. 66 + 4 pages.

4312* The Geochemistry of Rhenium, With Special Reference to Its Occurrence in Molybdenite. In molybdenite it ranges from none to 3250 ppm Re, and varies widely, even in samples from a single deposit. ***Michael Fleischer.*** *Economic Geology,* v. 54, no. 8, Dec. 1959, p. 1406-1413.

4313* Operation Todhunter. Large-scale mining project near Middletown, Ohio, will provide safe, low-cost underground storage for liquefied petroleum gas. ***R. L. Rough.*** *Explosives Engineer,* v. 37, no. 6, Nov.-Dec. 1959, p. 175-181.

4314 Cosmic Thunderstorms. Application of the writer's electrical discharge theory of some astrophysical phenomena are discussed, and interesting inter-relationships are adduced between corresponding physical processes in the laboratory and in the terrestrial, stellar, and galactic atmospheres. ***C. E. R. Bruce.*** *Franklin Institute, Journal,* v. 268, no. 6, Dec. 1959, p. 425-445.

4315 Geochemical Methods of Prospecting and Exploration for Petroleum and Natural Gas. Geochemical methods used in prospecting and exploring for petroleum in the Soviet Union. Interprets results and correlates them with data obtained from other procedures, and cites examples in which such methods have been successfully utilized in the discovery of oil and gas pools. The original Russian was published in 1954 by A. A. Kartsev, Z. A. Tabasaranskii, M. I. Subbota, and G. A. Mogilevskii. ***Paul A. Witherspoon and William D. Romey, editors.*** 349 pp. 1959. University of California Press, Berkeley and Los Angeles. ((TN270 K14gtr)

4316 Hydrology. Deals with the processes governing the depletion and replenishment of the water resources of the land areas of the earth. ***C. O. Wisler and E. F. Brater.*** 2nd Ed. 408 pp. 1959. John Wiley & Sons, New York. (GB661 W75h2)

4317* The Production of Whistlers by Lightning. If whistler production is related to a type of ionospheric control by the storm area, this connection may be reflected in meteorological conditions. ***E. L. Hill.*** *I.R.E. Proceedings,* v. 48, Jan. 1960, p. 117.

4318 Upper Mississippian and Pennsylvanian Megaspores and Other Plant Microfossils From Illinois. ***Marcia R. Winslow.*** *Illinois State Geological Survey, Bulletin* 86, 1959, 135 pp. (TN21 IL6.7b Vis.)

4319 Petroleum Industry in Illinois, 1958. I. Oil and Gas Developments. II. Waterflood Operations. ***Alfred H. Bell, et al.*** *Illinois State Geological Survey, Bulletin* 87, 1959, 117 pp. (TN21 IL6.7b Vis.)

4320 Visual Estimates of Grain Size Distribution in Some Chester Sandstones. A rapid method for obtaining large amounts of reasonably accurate data on the distribution and size of grains in consolidated sandy rocks. Grain-size distribution was estimated by measuring under a stereoscopic microscope. ***David H. Swann, Robert W. Fisher, and Mathias J. Walters.*** *Illinois State Geological Survey, Circular* 280, 1959, 43 pp. (TN21 IL6.7c Vis.)

4321 Hydraulic Fracture Theory. III. Elastic Properties of Sandstone. Elastic properties of the porous sandstones may be used in calculating the changes in underground stresses that take place as pore pressure changes. Knowledge of these stresses is important in recovery of oil. ***James M. Cleary.*** *Illinois State Geological Survey, Circular* 281, 1959, 44 pp. (TN21 IL6.7c Vis.)

4322 Theory of Acid Treatment of Limestone Formations. ***G. Rowan.*** *Institute of Petroleum, Journal,* v. 45, Nov. 1959, p. 321-334.

4323* A Scheme for Genetic Classification of Endogenic Ore-Forming Processes. Classification scheme for ore-forming stages associated with magma indicates close relationship between ore occurrences and granitoid magmas of particular composition, either at the surface or at depth. ***V. K. Chaykovsky.*** *International Geology Review,* v. 1, Nov. 1959, p. 37-47.

4324 Introduction to Historical Geology. Opens with a chapter on methods of historical geology, evolution of life, and the beginning of earth; then discusses systematically all the major geologic eras and points out the major developments taking place during each era. ***Raymond C. Moore.*** 2nd Ed. 656 pp. 1958. McGraw-Hill, New York. (QE501 M78i2)

4325* Meteor Radiant Distributions and the Radio-Echo Rates Observed by Forward Scatter. ***M. L. Meeks and J. C. James.*** *Journal of Atmospheric and Terrestrial Physics,* v. 16, nos. 3-4, Nov. 1959, p. 228-235.

4326* On a Pseudo-Iterating Method for Reduction of Observations of Earth-Tide for Effects From Tides of the Seas, With an Application to Observations Made at Bergen (Norway) 1934. ***J. Egedal.*** *Journal of Atmospheric and Terrestrial Physics,* v. 16, nos. 3-4, Nov. 1959, p. 318-323.

4327* Turbulence at Altitudes of 80-100 km and Its Effects on Long-Duration Meteor Echoes. ***J. S. Greenhow and E. L. Neufeld.*** *Journal of Atmospheric and Terrestrial Physics,* v. 16, nos. 3-4, Nov. 1959, p. 384-392 + 1 plate.

4328* The Determination of the Electron Distribution in the Upper Ionosphere From Satellite Doppler Observations. ***F. H. Hibberd and J. A. Thomas.*** *Journal of Atmospheric and Terrestrial Physics,* v. 17, nos. 1-2, Dec. 1959, p. 71-81.

4329 Natural Quartz From the Laboratory. Probes into the actual mechanism of quartz formation and some conclusions are drawn concerning the natural processes. ***James F. Corwin.*** *Journal of Chemical Education,* v. 37, Jan. 1960, p. 11-14.

4330* Quantitative Evaluation of the Density Log in the Rocky Mountain Area. A properly collimated logging tool will accurately measure bulk density of a formation. The intensity of γ rays (from the source) that have undergone Compton scattering in the formation can be recorded and related to the density of the particular medium. ***J. M. Edwards.*** *Journal of Petroleum Technology,* v. 11, Dec. 1959, p. 29-34.

4331* Field Consolidation of Fractured Core. Fragile core specimens are embedded in plastic and polymerized to permit future study of the core. ***F. R. Conley, J. A. Glover, and C. F. Knutson.*** *Journal of Petroleum Technology,* v. 11, Dec. 1959, p. 35-36.

4332* Effect of Pressure and Temperature on Cavities in Salt. To test the behavior of salt dome cavities for storage of atomic reactor fuel wastes, tests at pressure increments of 1,000 psi were conducted on a 2-in. cylindrical cavity contained in a 6-in. long x 6-in. diameter salt core. The cavity exhibited stability under pressures up to 3,000 psi and temperatures to 300 F. ***K. E. Brown and F. W. Jessen.*** *Journal of Petroleum Technology,* v. 11; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 216, Dec. 1959, p. 341-345.

4333 The Mineral Industry in Kansas in 1958. The mineral fuels and related products; nonmetallic minerals; metals; undistributed minerals; and unevaluated mineral resources. ***Walter H. Schoewe.*** *Kansas. State Geological Survey Bulletin No.* 134, pt. 7, 1959, p. 244-287. (TN21 K13b Vis.)

4334 Midwest Oil Register. Directory of producers and drilling contractors in Louisiana, Mississippi, Arkansas, Florida, and Georgia. 174 pp. 1959. C. L. Cooper, Drawer 7248, Tulsa, Okla. (T13 P44m1)

4335* Blasting Trial With a Nitric Acid Explosive. Trial was carried out to assess the blasting capabilities of a nitric acid explosive consisting of an O balanced mixture of dinitrotoluene and nitric acid. Results showed that the performance of the nitric acid explosive was consistent with its high power

and velocity. ***T. J. Reid and J. W. MacGregor.*** *Mine & Quarry Engineering*, v. 25, Dec. 1959, p. 536-540.

4336* X-Ray Studies of Synthetic Diamonds. Specimens of diamonds made by the General Electric Company and by Allmänna Svenska Elektriska Aktiebolaget, Västeras, Sweden, are studied. ***Kathleen Lonsdale and H. Judith Milledge.*** *Mineralogical Magazine and Journal of the Mineralogical Society*, v. 32, Sept. 1959, p. 185-201 + 2 plates.

4337* Geochemical Prospecting. ***Harold Bloom.*** *Mines Magazine*, v. 50, Jan. 1960, p. 12-16.

4338* Large Circular Underground Shaft Sinking at Climax. ***William F. Distler.*** *Mining Congress Journal*, v. 46, Jan. 1960, p. 42 + 3 pages.

4339* Peaceful Uses of Nuclear Explosions. Discusses three general applications: excavating, breaking rock in place, and utilizing the heat. ***S. G. Lasky.*** *Mining Congress Journal*, v. 46, Jan. 1960, p. 48-51.

4340 Spiral and Other Growth Forms of Synthetic Diamonds: A Distinction Between Natural and Synthetic Diamond. ***S. Tolansky and I. Sunagawa.*** *Nature*, v. 184, Nov. 14, 1959, p. 1526-1527.

4341 Calculation of Cosmic-Ray Ages in the Iron Meteorites 'Carbo' and 'Treysa'. ***H. Voshage and H. Hintenberger.*** *Nature*, v. 185, Jan. 9 ,1960, p. 88-89.

4342* Some Methods of Obtaining Large Sea-Water Samples From Depth. The construction and operation of three large-capacity sea-water samplers is described. The samplers have been used to obtain large samples for determination of ^{14}C activity of sea water. ***R. P. Willis.*** *New Zealand Journal of Science*, v. 2, no. 3, Sept. 1959, p. 393-397.

4343 Oil Reservoir Engineering. The reservoir rocks and structures; electric and radiation logging of wells; reservoir-fluid properties; mechanics of fluid flow in porous media; volumetric evaluation of oil-in-place and empirical reserve estimates; and a universal theory of reservoir engineering. ***Sylvain J. Pirson.*** 2nd Ed. 735 pp. 1958. McGraw-Hill, New York. (TN871 P66e2)

4344* Some Geological and Geophysical Methods for Modern Oil Exploration. ***Aynsley Hatton.*** *Petroleum*, v. 22, Sept. 1959, p. 301 + 3 pages.

4345 Modern Well Completion Series. III. Conditioning Mud for Well Completion. ***Robert W. Ruhe, Jr.*** *Petroleum Engineer*, v. 32, Jan. 1960, p. B22-B25.

4346* Determination of the Age of the Elements. A study of Xe^{129} in the chondritic (stone) meteorite Richardton. ***J. H. Reynolds.*** *Physical Review Letters*, v. 4, no. 1, Jan. 1, 1960, p. 8-10.

4347 The Properties and Behaviour of Some Artificial Ice Nuclei. ***B. J. Mason and A. P. van den Heuvel.*** *Physical Society, Proceedings*, v. 74, pt. 6, Dec. 1959, p. 744-755.

4348 Physics of the Earth's Interior. The structure of the earth; the earth's crust; temperature and thermal processes in the earth; density, pressure, gravity, and flattening in the earth; nonelastic processes in the earth. ***Beno Gutenberg.*** v. I. 240 pp. 1959. Academic Press, New York. (QE509 G98p)

4349* The Coming Role of Pozzolans. IV. Product Potential Through Process Design. ***Wolf G. Bauer.*** *Pit and Quarry*, v. 52, no. 7, Jan. 1960, p. 181 + 2 pages.

4350 Project Firefly. Attempts to gain more knowledge on the atmosphere between heights of 85 and 130 kilometers (50 and 80 miles). ***Howard D. Edwards.*** *Research Engineer*, v. 14, no. 5, Dec. 1959, p. 5-8.

4351* Methods of Continuous Extraction. Discusses mining by bore holes, applied to gaseous hydrocarbons, rock salt, S, china clay, Cu; gasification of coal *in situ;* transport by belt conveyers; hydraulic transport. The transported material is given a preliminary crushing below ground and is then introduced into a transport pipe containing water under pressure. *(In French.)* Methodes d'extraction continue. ***L. Vuchot and A. Ginnochio.*** *Revue de l'Industrie Minerale*, Spec. Issue, Nov. 15, 1959, p. 572-609.

4352 A Discussion on Space Research. Compilation of 13 separate papers dealing with such subjects as interplanetary space and the earth's outermost atmosphere; space research in relation to the moon and the nearer planets; astronomical observations with the aid of artificial satellites; radio astronomical measurements from earth sattellites; radio communication with a lunar probe; and analysis of the orbits of the Russian satellites. *Royal Society, Proceedings*, v. 253, ser. A, Dec. 29, 1959, p. 450-541.

4353 New World Prehistory. The main outlines of the pre-Columbian past are only beginning to emerge. ***Gordon R. Willey.*** *Science*, v. 131, Jan. 8, 1960, p. 73-86.

4354 The 600-Foot Radio Telescope. Description and operation of the world's largest steerable telescope now under construction in West Virginia. Its great power to gather radio waves and resolve celestial radio sources promises important advances in knowledge of the universe. ***Edward F. McClain, Jr.*** *Scientific American*, v. 202, no. 1, Jan. 1960, p. 45-51.

4355 The Green Flash. When the sun's disk is disappearing at sunset, or appearing at sunrise, its top sometimes momentarily turns a brilliant green. The flash results from dispersion of sunlight in air. ***D. J. K. O'Connell.*** *Scientific American*, v. 202, no. 1, Jan. 1960, p. 112 + 7 pages.

4356 Cosmic Spherules and Meteoritic Dust. Considers the occurrence of meteorites in sediments as a clue to history of the solar system. ***Hans Pettersson.*** *Scientific American*, v. 202, no. 2, Feb. 1960, p. 123 + 6 pages.

4357 How Can We Detect Radio Transmissions From Distant Planetary Systems? ***Frank D. Drake.*** *Sky and Telescope*, v. 19, no. 3, Jan. 1960, p. 140-143.

4358 McCrea's Theory of the Solar System's Origin. ***Otto Struve.*** *Sky and Telescope*, v. 19, no. 3, Jan. 1960, p. 154-156.

4359* Principal Hydrogeological Region Types on the Territory of the USSR. Individual parts of USSR territory are characterized by highly diverse hydrogeological conditions allowing identification of a great number of hydrogeological regions. Their principal types are artesian basins, characteristic of platforms and intermontane depressions, and crystalline shields. Interbed artesian waters prevail within artesian basins; fissure-vein underground waters—within hydrogeological massifs. Artesian basins and hydrogeological massifs are further subdivided. *(In Russian.)* Osnovnyye tipi gidrogeologicheskikh structur na territorii SSSR. ***I. K. Zaitsev.*** *Sovetskaia Geologiia*, v. 2, no. 11, Nov. 1959, p. 3-15.

4360* Terrestrial and Extraterrestrial Life. Discusses the hypothesis that life on earth was transported from some other planet by intelligent beings who either visited earth leaving behind their spores or who sent spores in space ships. ***Michael H. Briggs.*** *Spaceflight*, v. 11, no. 4, Oct. 1959, p. 120-121.

4361* Astronomy's Most Fascinating Problem. The origin and evolution of the solar system—now new knowledge of the stars in general can be applied to it. ***Otto Struve.*** *Technology Review*, v. 62, no. 3, Jan. 1960, p. 28-31.

4362 The Earth Beneath the Sea. Waves and currents modify the sea floor; catastrophic waves from the sea; the continental shelves that surround the lands; origin of continental shelves; the world's greatest slopes. ***Francis P. Shepard.*** 275 pp. 1959. The Johns Hopkins Press, Baltimore. (QE33 Sh47e)

4363 The Earth, Its Origin, History and Physical Constitution. New edition covers additional information on tidal friction, thermal history of the earth and surface features of the moon. ***Harold Jeffreys.*** 4th Ed. 420 pp. 1959. Cambridge University Press, London. (QE501 J36e4)

4364 Induced Polarization. A Study of Its Causes and Magnitudes in Geologic Materials. Physical properties of geologic materials indicate that only electrode interface and

diffusion flow phenomena are important sources of induced polarization effects. ***Theodore R. Madden and Donald J. Marshall.*** *U. S. Atomic Energy Commission, RME*-3160, June 1959, 80 pp. (TN21 Un3.1r Contin.)

4365 Mining Methods and Costs, Lincoln Tungsten Mine, Wah Chang Mining Corp., Lincoln County, Nev. ***A. C. Johnson and Ross M. McDonald.*** *U. S. Bureau of Mines Information Circular* 7907, 1959, 18 pp. (TN21 Un3i Vis.)

4366 Mining Methods and Costs at the Piokee Mining Unit and the Piokee Experimental Mining Project, the Eagle-Picher Co. (Tri-state Mines), Ottawa County, Okla. ***J. B. Elizondo.*** *U. S. Bureau of Mines Information Circular* 7930, 1959, 26 pp. (TN21 Un3i Vis.)

4367* Radio-Refractive-Index Climate Near the Ground. The radio refractive index of air is a function of atmospheric pressure, temperature, and humidity and is found to vary in a systematic fashion with climate. The surface value of the refractive index may be estimated four to five times more accurately from charts of reduced-to-sea-level values than from similar sized charts of surface index. ***B. R. Bean and J. D. Horn.*** *U. S. National Bureau of Standards Journal of Research, Section D, Radio Propagation,* v. 63D, no. 3, Nov.-Dec. 1959, p. 259-271.

4368* A Method for Measuring Local Electron Density From an Artificial Satellite. A method is proposed for known points in the outer ionosphere, by the use of vlf receiving equipment in an artificial satellite, in conjunction with a vlf transmitter on the ground. The transmitter would radiate continuous waves, which would be propagated through the ionosphere in the "whistler" mode. The basis of the method is a measurement of the local wave admittance of the medium, by comparison of the signals received on an electric dipole and on a loop. ***L. R. O. Storey.*** *U. S. National Bureau of Standards Journal of Research, Section D, Radio Propagation,* v. 63D, no. 3, Nov.-Dec. 1959, p. 325-340.

4369* Measured Frequency Spectra of Very-Low-Frequency Atmospherics. Results provide an excellent experimental basis for comparisons with the mode theory of vlf ionospheric propagation. ***Tatsuzo Obayashi.*** *U. S. National Bureau of Standards Journal of Research, Section D, Radio Propagation,* v. 64D, no. 1, Jan.-Feb. 1960, p. 41-48.

4370* Causes of Uranium Oxidation in the Uranites. During the phenomenon of uranium oxidation in the uranites, besides the usual and well-known process of antoxidation in accordance to the Kirsh-Khlopin reaction, which is significant for the inner parts of the crystals, a more intensive autoxidation takes place in the surface zones of the uranite crystals and of their segregations. The latter occurs by a loss of electrons, which fly out from the nuclei of radio-active elements, developing on the decomposition of U. The positive charge of the crystals of uranite converts each of them into a unique anode and a series of radiochemical reactions are probably the principal causes of formation of intensively oxidized surface zones. *(In Russian.)* O prichinakh okisleniya urana v uraninitakh. ***V. I. Lebedev.*** *Vsesoiuznoe Mineralogichesko Obshchestvo, Zapiski,* v. 88, 2nd ser., no. 6, 1959, p. 667-671.

4371* New Drilling Technique Recovers 100 Percent Continuous Core. Uses dual drill pipe, a highly portable rig, electric swivel, and a new concept of circulation practices. ***Homer Henderson and Jack F. Earl.*** *World Oil,* v. 150, Jan. 1960, p. 111-116.

4372* Drilling Costs Reduced With Aerated Seawater. ***G. A. Krahn, E. B. Rubsamen, Jr., and S. J. Mathews, Jr.*** *World Oil,* v. 150, Jan. 1960, p. 125-128.

See also: **3929** (solubility of $CaSO_4$ in concentrated sea brine); **4844** (solar heating).

GRAPHIC ARTS

4373* Magenta Contact Screen for Gravure. Discusses the principle of automatic control, the employment of a feedback or measurement to actuate a controlling mechanism. Certain specific instruments and controls are described and the advantages of automatic controls such as savings in time and materials, improvement in quality and elimination of human error pointed out. ***L. E. Goda, Jr.*** *Gravure,* v. 6, Jan. 1960, p. 14 + 3 pages.

4374* The Exhaustion of Phenidone Developers by Aeration, and the Superadditivity of Phenidone with Hydroquinone Monosulphonate. Developer solutions containing Phenidone and hydroquinone, both carbonate and borate based, were subjected to accelerated aeration. It was established that although the Phenidone concentration in such solutions is usually low compared with that of the hydroquinone, its stabilization by the latter is such that the loss of Phenidone by oxidation is only slight even when the aeration is continued well beyond the point where the hydroquinone has been converted entirely to the sulfonate. ***A. J. Axford.*** *Journal of Photographic Science,* v. 7, no. 5, Sept.-Oct. 1959, p. 120-125.

4375* Xerographic Development Methods. Of the five basic steps involved in making a xerographic reproduction–sensitization, exposure, development, transfer and fixing–the development process is examined in detail. The methods reviewed are development by dusting, cascade, reversal cascade, tone tray cascade, magnetic and fur brush, liquid immersion and powder cloud techniques. ***J. Hughes.*** *Journal of Photographic Science,* v. 7, no. 5, Sept.-Oct. 1959, p. 128-133.

4376* Information Theory and Photographic Images. The photographic image of an extended object possessing complex fine structure is "degraded" by three effects. (1) Limited resolution of the photographic objective, (2) spread of the image due to scattering of light by the grains of the undeveloped emulsion, (3) statistical fluctuation in the effective photographic response (sensitivity) from one small region of the emulsion layer to another, due to statistical fluctuations in the density of the silver grains in the developed emulsion. ***E. H. Linfoot.*** *Journal of Photographic Science,* v. 7, no. 6, Nov.-Dec. 1959, p. 148-156.

4377* Some Applications of a Microdensitometer to the Study of the Photographic Reproduction of Fine Detail. Describes the optical and sensitometric factors involved in the photographic reproduction of lines, edges and sine-curve test patterns. New data are presented which elucidate a discrepancy between the theory of resolving power and previous experimental observations. ***P. G. Powell.*** *Journal of Photographic Science,* v. 7, no. 6, Nov.-Dec. 1959, p. 157-161.

4378* A Scientific Approach to Assessing Image Quality. An historical description of concepts of optical imagery is given, commencing with the work of Abbe and Rayleigh. Several criteria for image quality arose in the course of these developments. Frequency response is the contemporary approach to understanding optical images. Its fundamental and all-embracing nature as an image criterion is explained. Attempts are made to correlate the frequency response results with requirements and findings of practical optics. ***W. S. Blaschke.*** *Journal of Photographic Science,* v. 7, no. 6, Nov.-Dec. 1959, p. 162-172.

4379* A Microdensitometer for Photographic Research. A recording microdensitometer similar to that described by Altman and Stultz (Microdensitometer for Photographic Research, Altman, J. H., and Stultz, K. F., *Review of Scientific Instruments* 27, 1033-1036, Dec. 1956) has been made for research on image structure in photographic materials. The scanning aperture is a slit of width adjustable down to about 1 μ and length up to about 700 μ. Response is linear with densities up to about 3·5 at this aperture. The record is made on rectangular co-ordinate chart-paper. ***N. K. Southwold and W. G. Waters.*** *Journal of Photographic Science,* v. 7, no. 6, Nov.-Dec. 1959, p. 174-177.

4380 General Differential Formulae of the Complete Projective Relations Between Planes. Differential formulae are derived for arbitrary mutual positions of the two planes and for different arrangements of the axes of rotations and of the sequence of the rotations. Applications to aerial and terrestrial photogrammetry. ***B. Hallert and L. Ottoson.*** *Kungliga Tekniska Högskolans Handlingar,* no. 140, 1959, 14 pp. (T4 K96t Vis.)

4381* **The March of Cameras.** There are more new cameras than new ideas. Yet production and competition march faster than markets expand. This paper reviews cameras of the 19th century and an outlook toward future developments. ***W. D. Emanuel.*** *Perspective*, v. 1, no. 3, 1959, p. 229-235.

4382* **Exposure Automation?** Discusses the modern day automation in the science of photography. ***Andrew Matheson.*** *Perspective*, v. 1, no. 3, 1959, p. 236-242.

4383* **Splitting Time Itself.** Sums up the present stage of development of high speed photography, and points to the directions in which future research is necessary or possible. ***H. Schardin.*** *Perspective*, v. 1, no. 3, 1959, p. 250-255.

4384* **Duplicate Platemaking.** As with original printing surfaces, duplicate plates possess important and unique characteristics for letterpress printing production. Each kind of plate has its advantages, its natural market, its fringe applications. Within the next few years, duplicate plates will face their most serious competitive challenge from original plates. The new one-bite and high-speed etching processes bring photoengravings into the competitive area. Another threat is presented by the DuPont Dycril photopolymer plate. The electrotyping industry will be the principal target for such competitors. Much development needs to be done in the whole area of printing plates. ***J. Homer Winkler.*** *Share Your Knowledge Review*, v. 41, no. 4, Jan. 1960, p. 10-15.

4385 Gamma Radiation Insensitive Television Camera Lenses. Vidicon and image-orthicon types of television camera lenses have been designed to utilize only those "non-browning" optical glasses especially developed to maintain their transparency in gamma-radiation fields. The optical and mechanical characteristics of these lenses as well as the performance test data are described. ***John D. Hayes.*** *Society of Motion Picture and Television Engineers, Journal*, v. 68, pt. 1, Dec. 1959, p. 816-818.

4386 Unified Analysis of Depths of Field and Focus. The depths of field and of focus contribute independently to the size of the circle of confusion in the viewing plane. An integrated analysis permits treating both a three-dimensional object space and a film surface that does not conform to the curvature of the image field, or is not smooth. The investigation is restricted to a symmetric lens in order to avoid complications concerning the size and location of entrance and exit pupils. ***Daniel Levine.*** *Society of Motion Picture and Television Engineers, Journal*, v. 68, pt. 1, Dec. 1959, p. 819-823.

4387 The Construction of Research Films. Designed to give sponsors and scientists an expert approach to documentary and educational film making. Covers basic principles and equipment and the full employment of existing research material. Discusses equipment technicians should use, latest developments in color filming, magnetic tape recording and modern cinematographic equipment. Problems of lighting, sound, animation and editing are covered, and common faults are pointed out. ***D. H. Densham.*** 104 pp. 1959. Pergamon Press, New York. (TR850 D43c)

See also: **4096** (magnetic printing inks).

HEAT POWER

4388 Development of a Three-Stage Liquid-Cooled Gas Turbine. A three-stage gas turbine was designed from nonstrategic, low alloy components to operate at 1750 F inlet temperature. The rotor blades are cooled with water in a closed system, and the stators are cooled with air. ***Sumner Alpert, R. E. Grey, and W. O. Flaschar.*** *ASME, Transactions, Series A, Journal of Engineering for Power*, v. 82, no. 1, Jan. 1960, p. 1-9.

4389* **What's Holding Back the Atom Powered Aircraft.** Present state of development and administrative difficulties are aired. ***John P. Kushnerick.*** *Aircraft and Missiles*, v. 2, Dec. 1959, p. 10-14.

4390* **Exhaust Back Pressure.** Effects on the performance of internal combustion engines. ***S. E. Bonamy and R. W. Upfold.*** *Automobile Engineer*, v. 49, Dec. 1959, p. 519-521.

4391 Producing Slant-Six Engines in Chrysler Trenton Plant. A pictorial survey of operations. ***Joseph Geschelin.*** *Automotive Industries*, v. 122, no. 2, Jan. 15, 1960, p. 59-62.

4392* **Testing Aircraft Engines Under High-Altitude Conditions.** ***F. Huber.*** *Brown Boveri Review*, v. 46, no. 8, Aug. 1959, p. 427-434.

4393* **Further Measurements of Turbulence Intensity in Flame Zones.** A technique for measuring turbulence intensity in flames by means of He diffusion from the concentration distribution of He (determined by sampling) downstream of a "point source" injection tube immersed in the main stream. Presents additional results obtained at several other positions in the same duct. ***A. A. Westenberg and J. L. Rice.*** *Combustion and Flame*, v. 3, no. 4, Dec. 1959, p. 459-465.

4394* **The Burning Velocity of Hydrogen—Air Mixtures and Mixtures of Some Hydrocarbons With Air.** ***T. G. Scholte and P. B. Vaags.*** *Combustion and Flame*, v. 3, no. 4, Dec. 1959, p. 495-501.

4395* **For Rocketry: High-Pressure Vessels Are Required.** *Compressed Air Magazine*, v. 64, Dec. 1959, p. 32-33.

4396 Design and Performance of Gas Turbine Power Plants. v. XI. High Speed Aerodynamics and Jet Propulsion. Work is divided into areas covering combustion chamber design, mechanical and metallurgical problems, and performance characteristics. ***W. R. Hawthorne and W. T. Olson, editors.*** 563 pp. 1960. Princeton University Press, Princeton, N. J. (TL709 H53)

4397* **No Propeller or Rudder on Jet Driven Boat.** This Dowty Turbocraft is propelled by a two-stage jet. *Engineering*, v. 189, Jan. 1, 1960, p. 21.

4398* **Producing High Voltage, AC or DC, From Heat.** Gives details of new development, by International Telephone and Telegraph Corp., based on the known phenomenon that the permittivity or dielectric constant of certain ferroelectric materials varies with temperature. *Gas Age*, v. 125, Jan. 21, 1960, p. 32-34.

4399* **The Morton Diesel.** Discusses an opposed-piston air-cooled engine from New Zealand in which screwed connections are eliminated. *Gas and Oil Power*, v. 54, Dec. 1959, p. 307-308.

4400* **A Small Rocket for Laboratory Demonstration.** Operates on gasoline and air. ***A. R. Deschere.*** *Journal of Engineering Education*, v. 50, no. 3, Dec. 1959, p. 251-253.

4401* **Small Free-Piston Engine Compressor.** Briefly covers the dynamic and power-generation aspects of a free-piston engine compressor that is intended for use in a residential air-conditioning system. The requirements of low initial cost, high efficiency, and compactness are met by the free-piston unit with its pneumatically operated fuel-injection system and only one basic moving part. The small unit has promise if designed to meet specific requirements. ***J. H. McNinch, W. W. Vogelhuber, and R. J. McCrory.*** *Mechanical Engineering*, v. 81, Dec. 1959, p. 57-60.

4402* **Nuclear Marine Propulsion in Russia, France and Japan.** ***J. R. Finniecome.*** *Mechanical World and Engineering Record*, v. 139, Dec. 1959, p. 512-516.

4403* **Prospects for Nuclear Powered Ships.** ***C. E. Steiner.*** *Nuclear Power*, v. 5, Jan. 1960, p. 108-110.

4404* **British Multi-Fuel Military Engine Development.** Opposed-piston two-strokes of from 30 b.h.p. to 700 b.h.p.: modified diesel designs to give standard performance on various fuels. *Oil Engine and Gas Turbine*, v. 27, Dec. 1959, p. 192-195.

4405* **Vee-Form Engines for Gas Boosting.** *Oil Engine and Gas Turbine*, v. 27, Dec. 1959, p. 196-197.

4406* A 500-H.P. Design of Moderate Fuel Consumption. New Budworth gas turbine combines proven aircraft and industrial features. *Oil Engine and Gas Turbine*, v. 27, Jan. 1960, p. 257-259.

4407* More Gas Pipeline Muscle per Dollar. Proposes to achieve a sharp reduction in compressor-station costs with two small, lightweight, ultrahigh-speed gas turbines operating in the 20,000-r.p.m. range. ***Gene T. Kinney.*** *Oil and Gas Journal*, v. 58, no. 4, Jan. 25, 1960, p. 120-121.

4408 Rocket Propellents. I. Liquid Propellents. Selection of liquid propellents and properties of some of the more interesting ones. ***W. G. Parker.*** *Research*, v. 13, Jan. 1960, p. 26-31.

4409 Rocket Propulsion. Provides the worker with a clear, accurate, detailed, and up-to-date treatise on scientific and technical documentation in this field. Its systematic approach initiates one into the technique of solid- and liquid-propellant rocket motors, as well as complex instability problems. ***Marcel Barrère, André Jaumotte, Baudouin Fraeijs De Veubeke, and Jean Vandenkerckhove.*** 829 pp. 1960. Elsevier Publishing Co., New York. (TL782 B27r)

4410* The Present State of Benson Boiler Control. ***Adalbert Fischer.*** *Siemens Review*, v. 26, no. 8, 1959, p. 245-251.

4411 Steam Power Plants. Starting, Testing, and Operation. Design and purchase; construction; plant operation; plant maintenance and automatic control equipment. ***Charles Donald Swift.*** 491 pp. 1959. McGraw-Hill, New York. (TJ400 Sw54s)

4412 Preliminary Test of Natural-Circulation Double-Tube Steam Generator. Testing of the Natural Circulation Steam Generator has been conducted with the Sodium Reactor Experiment. Transient and steady-state tests were run at power levels up to 19.5 Mwt. All tests indicate that the steam generator responds well and is stable. Over-all heat transfer coefficients for the boilers and superheater are, respectively, 507 and 180 Btu/hr-°F-ft^2. These values are within 11.5% of the theoretical values, 449 and 169 Btu/hr-°F-ft^2. ***R. D. Welsh.*** *U. S. Atomic Energy Commission, NAA-SR-3969*, Dec. 1, 1959, 29 pp. (UF767 Un3.1na Contin.)

See also: **3879** (ceramic rocket motor linings); **3958** (properties of water and water vapor in the critical region); **4288** (burning of monopropellant droplets); **4289** (detonation and ignition).

INFORMATION—PREPARATION AND DISSEMINATION

4413* A Brief Dictionary of American Superstitions. Not an encyclopedia but rather an organized sampling from the vast storehouse of the subject. ***Vergilius Ferm.*** 259 pp. 1959. Philosophical Library, New York. (AZ999 F38b Ref.)

4414 Write Letters That Get Action! It is an understatement, to say that most business letters are not really effective. Here are some specific ways to write letters that get a response. ***John A. Brown.*** *American Business*, v. 30, Jan. 1960, p. 38-39.

4415* Design and Development of an Engineering Report. Shows that an orderly and logical presentation of material is more important than skillful writing techniques and relates the organization of the report to a simple engineering problem. Explains why the engineer should originate the reports on his project and the growth in professional stature that will result. ***George B. Goodall.*** *Audio Engineering Society, Journal*, v. 8, no. 1, Jan. 1960, p. 41-45.

4416* Evolution of Dimensioning of Engineering Drawings. Discusses radical changes in dimensioning of engineering drawing brought about because of quantity methods of interchangeable manufacture. ***D. J. Clark.*** *Australasian Engineer*, v. 51, Oct. 1959, p. 48-52.

4417* Textbook Production for Television. Rinehart and Prentice-Hall tailor paper and hardbound editions in special formats within compressed schedules. ***Alice Freligh.*** *Book Production*, v. 71, no. 1, Jan. 1960, p. 44-46.

4418 Single Syllabus for Science. No science teacher could cope with the whole of modern scientific knowledge. But he could, perhaps, convey an idea of the framework into which this knowledge fits. *Engineering*, v. 188, Dec. 18, 1959, p. 636.

4419* A Marginal Punched Card System for Human Factors Literature. Describes the marginal punched card bibliographic system used by the Human Factors Group at Douglas Aircraft Company, Santa Monica, California. Discusses need for such a system, its development, and its merits. ***Carol S. Evans.*** *Human Factors*, v. 1, no. 4, Nov. 1959, p. 32-46.

4420* The Tufts Index to Human Engineering Literature. Reviews problems encountered in the development of a control system for the human engineering literature. The heterogeneity of the system and its flexibility is demonstrated in a topical outline and in selected examples of search terms. ***Donald B. Devoe and Ezra V. Saul.*** *Human Factors*, v. 1, no. 4, Nov. 1959, p. 47-54.

4421* Information Process Analysis. Information Process Analysis is a new charting technique developed by the General Electric Company to aid the introduction of electronic data processing systems in the office. It has applications considerably beyond this original purpose. However, the present discussion deals primarily with its application to electronic data processing. ***Burton Grad and Richard G. Canning.*** *Journal of Industrial Engineering*, v. 10, no. 6, Nov.-Dec. 1959, p. 470-476.

4422 7 Steps to Better Oral Reporting. ***E. J. Tangerman, editor.*** *Product Engineering*, v. 31, no. 2, Jan. 11, 1960, p. 38.

4423 Picture It the Easy Way With Perspective Grids. With gridded sheets, perspective views are a practical pictorial tool. ***T. O. McCartney.*** *Product Engineering*, v. 31, no. 2, Jan. 11, 1960, p. 40-43.

4424* Schematism. The schematic diagram is becoming more important as an aid to the writer in creating the proper mental image of systems and components in the mind of the reader of technical literature. Intended as an aid in the design of schematic diagrams. Emphasis is placed on simplicity and good layout to focus attention only on those fundamentals needed for rapid comprehension of an operational system. ***Robert L. Wallick.*** *STWE Review*, v. 7, no. 1, Jan. 1960, p. 6-11.

4425* The College Professor of English and On-the-Job Training. ***Erwin R. Steinberg.*** *STWE Review*, v. 7, no. 1, Jan. 1960, p. 12-14.

4426* In-Service Training for the Writer-Scientist. Explains the training methods used at the U. S. Army Chemical Corps Laboratories, Fort Detrick, Md. ***Madeline D. Warnock.*** *STWE Review*, v. 7, no. 1, Jan. 1960, p. 15-17.

4427 A Comparison of Learning Resulting From Motion-Picture Projector and From Closed-Circuit TV Presentations. In an attempt to standardize military service requirements for motion-picture projector noise levels, training films at various projector noise levels were shown to students. The same films were also shown over a closed-circuit TV system to equivalent groups. A comparison of the results obtained with respect to "learning" is presented. ***J. F. McGrane and Morton L. Baron.*** *Society of Motion Picture and Television Engineers, Journal*, v. 68, pt. 1, Dec. 1959, p. 824-827.

4428* International Documentation in Atomic Energy. Dissemination policies and sources of information are described. ***I. A. Warheit.*** *Special Libraries*, v. 51, no. 1, Jan. 1960, p. 7-10.

4429* Documentation in Latin America. ***George Crossmann.*** *Special Libraries*, v. 51, no. 1, Jan. 1960, p. 18-21.

4430* Documentation in the Field of Atomic Energy in Latin America. ***Emma Linares.*** *Special Libraries*, v. 51, no. 1, Jan. 1960, p. 22-24.

4431* National Documentation Services in Canada. ***Jack E. Brown.*** *Special Libraries*, v. 51, no. 1, Jan. 1960, p. 25-29.

4432 Machine Searching: Boon to Research. Describes A.S.M's Metals Documentation Service. *Steel*, v. 146, Jan. 11, 1960, p. 38-39.

4433 Binary Nitrogen Compounds of the Elements: A Literature Survey. Survey disclosed the existence of 195 binary compounds of N with the other elements of the periodic system. About 80% of the known binary compounds are nitrides while the rest are azides. Combinations with at least 75 elements are reported. A comprehensive bibliography and a set of tables designed to make it convenient for a researcher to locate preparative, crystallographic, or thermodynamic data are included. ***Rosemary G. Ehl, Rodney J. Sime, and John L. Margrave.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Note* 59-115, June 1959, 75 pp. (TL507 Un3.18t Contin.)

See also: **4836** (rubber bibliography).

INSTRUMENTATION

4434 Microscopical Scientists. II. Their Activities and Microscopes. Discusses some of the instruments and techniques that have helped advance the science of microscopy and its use in research and industrial operations. Information gathered from a symposium. *Analytical Chemistry*, v. 32, Feb. 1960, p. 21A-28A.

4435 A Digitizing Print-Out Mechanism Capable of Automatically Carrying Out Simple Mathematical Conversions. A simple and relatively inexpensive printing mechanism automatically prints and records in tabular form colorimetric data presented to it. Data are printed by an engraved counter wheel driven either by mechanical rotation or by a servomotor balanced by a Wheatstone bridge and an alternating current amplifier circuit. ***D. H. Simmonds and R. J. Rowlands.*** *Analytical Chemistry*, v. 32, Feb. 1960, p. 256-259.

4436* Resistance Thermometry. An account of the latest developments as well as established practice in this branch of temperature measurement is given. ***K. M. Greenland.*** *Control*, v. 3, no. 19, Jan. 1960, p. 94-97.

4437 Russian Test Equipment for Audio, Radio, and Microwave Measurements. It appears that because of strong central planning, only a minimum choice of standardized electronic test equipment is available to Russian technicians. Since there is no commercial competition, no effort is apparent in streamlining instruments or miniaturizing equipment. The equipment appears bulky, but functional. ***Bruno O. Weinschel.*** *IRE Transactions on Instrumentation*, v. I-8, no. 3, Dec. 1959, p. 67-78. (TK1 In6.6i Vis.)

4438* Instrumentation for Space Medicine Applications. Seven factors can be maximized to ensure a superior reliability level in missile electronics: design factors, transistor selection, transistor aging, resistor selection, quality control in assembly and testing, and application engineering. ***Wilson Greatbatch.*** *Military Systems Design*, v. 3, no. 6, Nov.-Dec. 1959, p. 314-315.

4439 R.P.M. Indicator and Overspeed Trip. The function of this dual-purpose instrument is (i) a coarse r.p.m. indicator and (ii) an adjustable overspeed trip relay having two overlapping ranges of 11,000 to 16,000 r.p.m. and 15,000 to 20,000 r.p.m. The instrument requires approximately 8 watts of power from a 110-volt a-c. line. Solid-state amplifiers and saturable core transformers provide virtually trouble-free operation. The input signal is derived from a magnetic proximity pick-up. The overspeed trip contact can be set to make within ± 30 r.p.m. of a chosen speed. The accuracy of the r.p.m. indication on the expanded scale meter is better than 0.1%. ***R. J. Harron.*** *National Research Council of Canada, Mechanical Engineering Report*, MI-819, May 8, 1959, 5 pp. + 3 plates. (TJ1 N21.5m Contin.)

4440 Physicochemical Measurements at High Temperatures. Book is designed to provide the research worker with the general information required during the planning of a research program involving high-temperature measurements as well as the detailed information needed during the conduct of the investigation. It brings together a presentation, critical discussion, and comparison of the various techniques available for measurements at high temperatures. ***J. O'M. Bockris, J. L. White, and J. D. Mackenzie, editors.*** 394 pp. 1959. Academic Press, New York. (QC276 B63p)

4441 Property Measurements at High Temperatures. Covers factors affecting, and methods of measuring, material properties at temperatures above 1400 C for those who are faced with the development or application of materials at unusually high temperatures. All important high-temperature properties are discussed, including heat conduction and radiation, density and thermal expansion, strength, elasticity of solids, viscosity, electrical and magnetic properties, and surface energy. ***W. D. Kingery.*** 416 pp. 1959. John Wiley & Sons, New York. (TA407 K59p)

4442 Logarithmic Characteristic of Triode Electrometer Circuits. The triode-connected 5889 electrometer tube was found to be useful as a logarithmic element over a grid current range of 10^{-14} to 10^{-6} amp. The relationship of plate current to grid current was carefully studied over a span of three and one-half decades as a function of the plate supply potential, the plate circuit load resistance, and the filament voltage. A circuit was developed for use in an ionization chamber survey instrument. ***Stanley K. Chao.*** *Review of Scientific Instruments*, v. 30, Dec. 1959, p. 1087-1092.

4443 Mass Spectrometer Leak Detector With Improved Sensitivity. A new type of mass spectrometer leak detector is described which has a sensitivity for helium of 10^{-12} standard cc/sec with a signal-to-noise ratio of unity. Operating pressure is in the 10^{-5} to 10^{-6} mm Hg range, time for 2/3 of final response is 2 sec or less, and operating characteristics are similar to present helium-sensitive mass spectrometer leak detectors. ***John L. Peters.*** *Review of Scientific Instruments*, v. 30, Dec. 1959, p. 1093-1095.

4444 Probability Density Measurement With an Electrode Mounted in the Face of a Cathode-Ray Tube. A small electrode mounted inside the face of a cathode-ray tube gives a "window" comparable to its own dimensions when the bias voltages are set so that secondary electron emission current dominates. Under these conditions the device can be used for measurement of probability densities of random signals. ***Hwachii Lien.*** *Review of Scientific Instruments*, v. 30, Dec. 1959, p. 1100-1102.

4445 Pulse-Height Analyzer for Neuro-Physiological Applications. A five-channel differential pulse-height analyzer is described, designed specifically for the observation of action potentials in nerve fibers. By measurement of the pulse amplitudes, it is possible to follow the activity of one or more single nerve fibers continuously. ***R. M. Littauer and C. Walcott.*** *Review of Scientific Instruments*, v. 30, Dec. 1959, p. 1102-1106.

4446 Transistorized Distributed Amplifier. Some analytical and experimental results are given for a transistorized distributed amplifier using the common emitter configuration. The characteristic impedances of the base and collector transmission lines are both 43.4Ω. A 4-section amplifier stage yields a mid-frequency gain of 5.1 db and an upper half-power frequency of 290 Mc. The low-frequency response is reasonably constant down to 10 cps. ***Charles W. McMullen.*** *Review of Scientific Instruments*, v. 30, Dec. 1959, p. 1109-1113.

4447 Wagner-Earth and Other Null Instrument Capacity Neutralizing Circuits. A simple but exact derivation of the conditions for ground potential on the null instrument input in nongrounded ac bridges is given. It is shown that not only the "Wagner-earth", but also other networks and circuits between the power source and the ac bridge can easily fulfill these conditions. Advantages of such other networks and circuits are discussed. ***Hanns H. Wolff.*** *Review of Scientific Instruments*, v. 30, Dec. 1959, p. 1116-1122.

4448 The Measurement of Thickness. Describes methods for the measurement of thickness in laboratory or shop by mechanical, electrical, magnetic, optical, chemical, X-ray, and radiation-absorption methods. ***George Keinath.*** *U. S. National Bureau of Standards, NBS Circular* 585, Jan. 20, 1958, 79 pp. (T21 Un3c Contin.)

LUBRICATION AND FRICTION

4449* Development of Radiation Resistant Oils. The objective was to develop oils of maximum radiation stability from readily available ingredients. Lubricants in three viscosity grades were made with alkylbenzenes containing selected polymers and additives. Each new oil was subjected to standard tests to determine if it met the specifications for presently used products made from mineral oils. The special oils complied with most requirements, and shortcomings were generally correctable. ***J. G. Carroll and R. O. Bolt.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 1-6.

4450* The Effects of High Energy Ionizing Radiation on Turbine Oil Performance Characteristics. Representative turbine oils and turbine oil components were exposed to electron radiation and evaluated for radiation-induced changes in functional characteristics. The irradiated oils were examined by numerous laboratory techniques including those established by the ASTM Committee C on Turbine Oils. As a result of exposure to radiation, changes were noted in turbine oil viscosity, oxidation stability, rust resistance, foaming susceptibility, color and other properties. ***C. F. Kottcamp, R. P. Nejak, and R. T. Kern.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 7-12.

4451* Viscoelastic Behavior of Greases. On the basis of the experimental results, it can be concluded that the vibration tester method, developed for the study of viscoelastic materials, can be successfully applied to greases. It was shown that the moduli of greases change little with frequency but change considerably with changes in amplitude and temperature. Decreases in the clearance used in deforming the grease were found to decrease the value of the moduli and reflect the shear sensitivity of greases. ***E. O. Forster and J. J. Kolfenbach.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 13-24.

4452* A Study of Design Criteria for Oscillating Plain Bearings. The load-life and friction characteristics of sleeve-bearing materials were determined under conditions simulating airframe operation. The bearings were grease lubricated, and operation was oscillatory (±45-degree amplitude). All bearing evaluations were conducted at room temperature. Design charts relating bearing load and wear to life in terms of cycles of oscillation were constructed from the data. Frictional characteristics were also studied. Aluminum bronze was found satisfactory as a bearing material when used with hardened SAE 4340 steel shafts for loads up to 15,000 psi. Steady-state load conditions were found more severe than reversing-load conditions. ***W. A. Glaeser and C. M. Allen.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 32-38.

4453* Adhesion Between Metals and Its Effect on Fixed and Sliding Contacts. By studying the coefficient of adhesion as a function of the applied stress, Amonton's law of friction was verified from the adhesion side, thus confirming the Bowden-Tabor theory of stick-slip friction. Adhesion between metals due to compression, occurring over a finite time, is essential for such connections as the solderless wrapped connection and is important for contacts left under pressure in the same position for a length of time as in printed circuit type connections. Adhesion between metals caused by both compression and shear is the cause for mechanical seizure, plowing, and wear experienced in sliding contacts. ***Warren P. Mason.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 39-49.

4454* Transition Temperatures in Sliding Systems. A pin-on-disk type of apparatus was used to study the effect of operating variables on transition temperatures with dilute solutions of pure fatty acids in pure paraffinic hydrocarbons and with a straight paraffinic mineral oil. It was found that the temperature at which the sudden transition from low to high friction and wear occurs increases with sliding speed, decreases with load, and is otherwise independent of operating variables. Empirically, the reciprocal of the absolute transition temperature varies linearly with the logarithm of the ratio of load to speed. The absence of conventional hydrodynamic lubrication in this system is demonstrated. ***R. S. Fein, C. N. Rowe, and K. L. Kreuz.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 50-57.

4455* The Conduction of Current in Bearings. Shows that the wear-rate due to electrical pitting is not a function of any single factor such as voltage, current, or wattage, but is dependent on a combination of many factors including the voltage, the circuit resistance, and the film thickness. If the film thickness is zero, the current is proportional to the voltage and large currents can be carried at negligible wear rates. ***H. N. Kaufman and J. Boyd.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 67-77.

4456* A Surface Effect Associated With the Use of Oils Containing Zinc Dialkyl Dithiophosphate. It is shown that the operation of engines on crankcase oils containing appreciable amounts of zinc dialkyl dithiophosphate can increase the small-scale roughness of the lifter-foot surfaces. In addition, the small-scale roughness can be reduced by subsequent operation of the same engine parts on oils containing no zinc dialkyl dithiophosphate. This change in roughness coincides with a change in reflectivity that can be detected visually. ***Paul A. Bennett.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 78-90.

4457* Film Formation by an Antiwear Additive in an Automotive Engine. Experiments carried out in a laboratory multicylinder gasoline engine with mineral oil lubricants containing radioactive (P^{32}-labeled) zinc di(C_8)alkyl dithiophosphate show that strongly attached films are formed by this compound on many of the rubbing metal surfaces of the engine. Results are presented on the effects of chemical treatments on the radioactivity of the metal surfaces and on a technique by which the films are removed and assayed with a Geiger counter. ***M. J. Furey.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 91-100.

4458* Testing and Operation of Ball Bearings Submerged in Liquefied Gases. Describes apparatus used to measure frictional torque, wear, and to make life tests. Presents the information concerning ball bearings obtained from this equipment and some bearing information obtained from an apparatus designed to make basic pump studies. Frictional torque data, wear data, and pictures showing a few of the test ball bearings are included. ***K. B. Martin and R. B. Jacobs.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 101-107.

4459* Effect of Fiber Orientation, Temperature and Dry Powder Lubricants on Rolling Contact Fatigue. The rolling contact fatigue spin rig was used to study the interrelation of fiber orientation and fatigue. In both balls and specially oriented races, a concentration of fatigue failures was observed in regions with the highest angle of intersection of fiber flow lines with the surface. The fatigue life of M-1 tool steel balls decreased with increasing temperature when using a synthetic lubricant, and was low with dry powder lubricants at 450 F, possibly due to the lubricant particles acting as mechanical stress raisers within the contact zone. ***W. J. Anderson and T. L. Carter.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 108-120.

4460* Rolling Contact Fatigue Evaluation of Bearing Materials and Lubricants. A high-temperature tester was built, and several months of testing at 400 F have shown that (a) the state of oxidation of diesters is a significant factor with several materials, (b) life can vary appreciably between apparently similar heats of steel, (c) hardness is an important factor that needs much more study, (d) standard cleanliness measurements do not seem to be sufficient to establish relative quality. ***E. G. Jackson.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 121-128.

4461* A Theoretical Study of the Effect of Offset Loads on the Performance of a 120° Partial Journal Bearing. Reynolds' equation for a 120° partial journal bearing of the clearance type having an L/D ratio of 1 is solved numerically to determine the effect of positioning circumferentially the line of action of the load at various points along the bearing arc.

The influence of the load position on film thickness, eccentricity, journal position, friction, flow, temperature rise, and maximum film pressure is investigated and performance curves given. It is shown that the position of the load has a significant effect on bearing performance. ***A. A. Raimondi.*** *ASLE Transactions*, v. 2, no. 1, Apr. 1959, p. 147-157.

4462* On the Behaviour of Rollers in a Cylindrical Roller Bearing. Each roller in a cylindrical roller bearing performs both two-dimensional planetary motion (i.e., rotation and revolution), and three-dimensional skewing action. This behavior, along with many other factors, affects the bearing characteristics such as running noise, friction, etc. To study the relations between roller motion and such characteristics, rotation and revolution of rollers were observed and photographed by stroboscope. ***Kōsaku Iida and Akio Igarashi.*** *Bulletin of JSME*, v. 2, no. 8, Nov. 1959, p. 538-545.

4463* Determination of Load Carrying Capacity of Lubricating Oil by I. A. E. Type Gear-Lubricant Testing Machine. ***Mitsuru Toyoguchi and Yoshiro Takai.*** *Bulletin of JSME*, v. 2, no. 8, Nov. 1959, p. 545-550.

4464* Effect of Finish Grade on the Wear of a Diesel Engine Cylinder Wall. Tests were made on a diesel engine which had both fine-bored and honed cylinders. Wear of a honed cylinder is smaller than that of a fine-bored cylinder at initial stage, but with regard to the total wear, there is no difference between them. Honed cylinders shorten the fitting time, but fine-bored cylinders serve the purpose in other respects. ***Yasutoshi Nakayama and Hideo Endō.*** *Bulletin of JSME*, v. 2, no. 8, Nov. 1959, p. 584-593.

4465* A Study of Open Gear Lubrication. Relationship between composition and performance of gear lubricants. Development of laboratory methods to evaluate improved lubricants; comments on field performance. ***C. R. Daniels and P. L. Malloy.*** *NLGI Spokesman*, v. 23, no. 11, Feb. 1960, p. 428-431.

4466* A Modified Clay Thickener for Lubricating Fluids. A new gelling agent for the preparation of lubricating greases is described. Based upon a specially processed clay and dimethyl alkyl benzyl ammonium chloride, the product is known commercially as Baragel 24. Laboratory data are given on a number of the important variables encountered in grease manufacture. ***R. E. Fariss.*** *NLGI Spokesman*, v. 23, no. 11, Feb. 1960, p. 432-437.

4467 A Laboratory Evaluation of Extreme Pressure Additives. Mode of action of organic compounds containing Cl and/or S as extreme pressure additives and reasons why chemically related compounds exhibit different EP properties. ***V. Oakes.*** *Scientific Lubrication*, v. 11, Dec. 1959, p. 16 + 7 pages.

See also: 3877 (bearings for tunnel kiln cars); **4479** (optimum bearing locations); **4559** (fatigue of vacuum-melted bearing steels); **4801** (wear and friction of filled polytetrafluoroethylene).

MECHANICAL ENGINEERING

4468* The Stress Concentration Factors in Cylindrical Tubes With Transverse Circular Holes. The "frozen stress" techniques of photoelasticity were used to determine maximum stress in tension, bending and torsion. In all cases, the maximum stress occurs inside the bore of the hole. The accuracy of all the graphs of stress concentration factors is better than 5%. ***H. T. Jessop, C. Snell, and I. M. Allison.*** *Aeronautical Quarterly*, v. 10, pt. 4, Nov. 1959, p. 326-344.

4469* Marine Gears; Present Position and Future Development. Various aspects of use of gears with hardened teeth. ***C. G. Wahl.*** *Brown Boveri Review*, v. 46, no. 8, Aug. 1959, p. 435-442.

4470* Compressive or Shearing Buckling Load and Fundamental Frequency of a Rhomboidal Plate With All Edges Clamped. Buckling problems of a rhomboidal plate with all edges clamped, on which compressive or shearing force is applied along its edges, are studied by using the energy method (Lagrangian multiplier method). Natural vibrations of the plate are also considered. The lowest buckling loads and the fundamental frequencies for several oblique angles are calculated. ***Minoru Hamada.*** *Bulletin of JSME*, v. 2, no. 8, Nov. 1959, p. 520-526.

4471 Kinematic Properties of the Three-Gear Drive. Equations for determination of rotation, angular velocity, and acceleration of the output shaft. Two worked-out numerical examples are included. ***M. F. Spotts.*** *Franklin Institute, Journal*, v. 268, no. 6, Dec. 1959, p. 464-473.

4472* Thermal Buckling of Circular Cylindrical Shells Under Circumferential Temperature Gradients. The thermal buckling of thin-walled circular cylindrical shells due to axial stresses caused by variations in temperature around the circumference is analyzed. This problem is of considerable importance in the structural design of high-speed airplanes and missiles, since they are subjected to high rates of aerodynamic heating. The analysis is performed with the aid of Donnell's equations, which can be shown to be satisfactory for the problem under consideration. The variation of the thermal stress with the circumferential coordinate is represented by Fourier series; the stresses are assumed constant through the thickness and in the axial direction. ***David Abir and S. V. Nardo.*** *Journal of the Aero/Space Sciences*, v. 26, Dec. 1959, p. 803-808.

4473* Buckling of a Cylindrical Shell Under a Circumferential Band Load. A method is presented for calculating the buckling pressure for a long, circular cylindrical shell subjected to external pressure over a circumferential band of arbitrary width. The "Euler" buckling pressure is determined. Stability is based on the principle of minimum potential energy, and the Ritz procedure is used to reduce the system to a finite number of degrees of freedom. ***D. O. Brush and F. A. Field.*** *Journal of the Aero/Space Sciences*, v. 26, Dec. 1959, p. 825-830.

4474 Stabilized Torque Magnetometer. Enables measurements of torque to be made with high precision and under conditions of complete stability. The specimen torque is balanced by means of an electric current passing through the coil of a moving coil meter movement, which replaces the normal torsion head and wire. A small permanent magnet is mounted on an extended movement pointer, so that one pole is capable of restricted motion in the field of two opposing current-carrying coils, which provide the necessary stability. ***W. F. Archenhold, A. C. Brown, and J. E. Thompson.*** *Journal of Scientific Instruments*, v. 36, Dec. 1959, p. 505-506.

4475 Stress and Deflection in Shafts. Describes a moment-distribution method for finding stresses and a graphical-integration method for finding deflections for a shaft that has three or more supports. ***V. J. Lopardo and W. M. Lee.*** *Machine Design*, v. 31, Dec. 10, 1959, p. 173-182.

4476 Thrust for Propulsion. Presents design data and equations obtained from a new method for analyzing off-the-road locomotion. ***M. G. Bekker.*** *Machine Design*, v. 31, Dec. 24, 1959, p. 92-101.

4477 How to Simplify Design of Close-Fit Bolt Assemblies. How to meet special joint requirements by combining certain standard bolts with holes reamed to suit the bolt-body diameter. ***Walter S. Brown.*** *Machine Design*, v. 31, Dec. 24, 1959, p. 102-103.

4478 The Mobility Method. II. Mechanical-Network Analysis. How to apply fundamental concepts of the mobility method to dynamic analysis of complete mechanical systems. ***Richard P. Thorn.*** *Machine Design*, v. 31, Dec. 24, 1959, p. 104-111.

4479 Optimum Bearing Locations. A method for determining the distance between bearings on a rotating shaft to raise the critical speed to a maximum value for safe operation. ***R. T. Bohm.*** *Machine Design*, v. 31, Dec. 24, 1959, p. 117-119.

4480 Minimum-Weight Tubular Members. A simplified method for direct determination of the dimensions of round

tubes which are subjected to torsion and internal pressure. ***B. Saelman.*** *Machine Design*, v. 31, Dec. 24, 1959, p. 129-131.

4481* Mechanical Power Transmission. Belts, Chains, and Gears. Reviews properties, capabilities, and design factors of these basic power-transmission drive devices. The toothed belt has rapidly found wide acceptance because of its positive drive and high-speed ratings. Continual improvements in materials, heat-treat processing, and close tolerance manufacturing methods have resulted in chains which have higher strength and longer life. Developments in gearing are now pointed toward three objectives: greater capacity for a given size; greater speed capability; improved reliability. ***E. S. Cheaney, C. L. Paullus, and W. C. Raridan.*** *Mechanical Engineering*, v. 81, Dec. 1959, p. 61-66.

4482 The Freezing and Melting Times of Slabs and Cylinders. General results for the time required to freeze or melt slabs or circular cylinders of a pure substance initially at the fusion temperature and exposed to a constant ambient temperature were obtained on the PACE analogue computer. The results for slabs agree with previously published results. ***D. C. Baxter.*** *National Research Council of Canada, Mechanical Engineering Report*, MK-1, Feb. 1959, 41 pp. (TJ1 N21.5m Contin.)

4483 Equipment for "Watching" Propagating Stress Waves. The propagation of stress waves generated by impact may be "watched" photoelastically with the use of the simple experimental arrangement described. In addition to providing control over the observed progress of the wave, the apparatus makes possible photography of the wave with conventional cameras. ***Herbert Becker.*** *Review of Scientific Instruments*, v. 30, Dec. 1959, p. 1107-1109.

4484 The Propagation of Thermal Stresses in Thin Metallic Rods. If the temperature in an elastic rod is not uniform and if it varies with time, dynamic thermal stresses are set up in the rod. Simple waves in an infinite rod are first discussed and then boundary value problems for semi-infinite rods and rods of finite length. Concludes with an account of an approximate method of solving the equations of thermoelasticity. ***I. N. Sneddon.*** *Royal Society of Edinburgh, Proceedings*, Sec. A, Mathematical and Physical Sciences, v. 65, pt. 2, 1958-59, p. 121-142. (Q41 R80.7p Vis.)

4485 The Dynamic Stresses Produced in Elastic Bodies by Uneven Heating. The presence of a non-uniform distribution of temperature in an elastic solid gives rise to an additional term in the generalized Hooke's Law connecting the stress and strain tensors and to a term involving the time rate of change of the dilatation in the equation governing the conduction of heat in the solid. First, the elastic solid is regarded as being of infinite extent and the distribution of temperature in the solid is produced by heat sources whose strength may vary with time. Second, the solid is supposed to be semi-infinite and to be deformed by prescribed variations in the temperature of the bounding plane and by heat sources within itself. ***G. Eason and I. N. Sneddon.*** *Royal Society of Edinburgh, Proceedings*, Sec. A, Mathematical and Physical Sciences, v. 65, pt. 2, 1958-59, p. 143-176. (Q41 R80.7p Vis.)

4486 The Dynamical Behaviour of a Strut in a Truss Framework. The relation between axial load and axial deformation for a strut generally involves an increase of deformation with decreasing load after the maximum load is reached. Assuming a relation of this form, and assuming also that the tension members obey Hooke's law, the behavior of a particular redundant pin-jointed truss which contains a single compression member and is subjected to dead load is examined in detail. Shows that when the applied load is such that the load in the strut has reached its maximum value, equilibrium may be lost temporarily, and the structure then undergoes what is termed a dynamic jump to a new position of equilibrium. ***G. Davies and B. G. Neal.*** *Royal Society, Proceedings*, v. 253, ser. A, Dec. 29, 1959, p. 542-562.

4487 Elastic Waves in Anisotropic Media. The displacements due to a radiating point source in an infinite anisotropic elastic medium are found in terms of Fourier integrals. The integrals are evaluated asymptotically, yielding explicit expressions for displacements at points far from the source. The relative amplitudes of waves from a point source are thus determined, and it is found that although, in general, the decay of wave amplitudes is proportional to the distance from the source, it is possible that in certain directions the decay is less than this. ***V. T. Buchwald.*** *Royal Society, Proceedings*, v. 253, ser. A, Dec. 29, 1959, p. 563-580.

4488 Statics of Thin-Walled Elastic Shells. Equilibrium equations of an elastic, symmetrically loaded shell of revolution; solution of the fundamental differential equations for shells of the simplest geometrical shapes; approximate solution of fundamental differential equations of a symmetrically loaded shell of revolution. ***A. I. Lur'e.*** *U. S. Atomic Energy Commission, AEC-tr-3798*, Oct. 1959, 210 pp. (UF767 Un3.1ae Contin.)

4489 Minimum-Weight Analysis of Symmetrical-Multi-web-Beam Structures Subjected to Thermal Stress. Analysis is based upon buckling and yielding stresses. Curves of minimum structural weight and optimum values of the beam parameters are shown as a function of bending moment for various temperature differences between skin and web. Two examples are given of the use of the curves to obtain minimum-weight beams. ***Robert R. McWithey.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-104*, Oct. 1959, 30 pp. (TL570 Un3t Vis.)

4490 Calculated Effective Thermal Conductivities of Honeycomb Sandwich Panels. The steady-state temperature distribution through honeycomb-type sandwich panels is calculated with simultaneous radiation and conduction. Based on this temperature distribution, the heat which will be transmitted is calculated. An effective thermal conductivity is defined and calculated. Results are presented in dimensionless form. ***Robert T. Swann.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-171*, Dec. 1959, 24 pp. (TL570 Un3t Vis.)

METALLURGY

4491* Alloys of Copper, Nickel, and Tantalum. These alloys have good tensile properties at moderately elevated temperatures and, since they can be hot and cold worked nearly as easily as cupronickel, they are suggested for service at temperatures above the usual limits for Cu alloys. ***Cyril Stanley Smith.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 905-909.

4492* The Effects of Variations in Nitrogen and Manganese Content on the Structure and High-Temperature Properties of Cast X-40 Alloy. Cast X-40 alloy with the lowest N content studied had a 100-hr rupture stress at 1500 F about equal to the reported value for the commercial alloy. Increases in N content progressively decreased the rupture strength, and with about 0.1 to 0.2% N a minimum strength was reached, but there was no accompanying change in microstructure. Further increases in N resulted in the formation of progressively increasing amounts of a lamellar, pearlitic-type structure at the grain boundaries, with accompanying increases in rupture strength, and above about 0.25 to 0.33% N, the rupture strength exceeded the normally reported values. Two series of melts representing different melting stocks exhibited minimum rupture strengths at different N contents. This suggests that some unidentified trace element not removed by vacuum melting has a strong influence on the response of this alloy to variations in N content. In a series of melts with Mn contents ranging from 0.6 to 3.2%, the material with the lowest Mn content had the highest 100-hr rupture strength at 1500 F. The Mn variations had no appreciable effect on the microstructure. ***E. E. Fletcher and A. R. Elsea.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 917-925.

4493* Internal Oxidation of Copper-Aluminum Alloys. This investigation was concerned with aluminum-oxide particle dispersions, the mechanical properties, and the recrystallization characteristics of some internally oxidized Cu-Al alloys. Observed hardness variations are in agreement with variations in oxide particle size revealed by electron metallographic studies. The oxide particles offer a considerable restraint to

softening during annealing after cold deformation. ***D. L. Wood.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 6, Dec. 1959, p. 925-932.

4494 The Preparation of a New Crystalline Modification of Boron, and Notes on the Synthesis of Boron Triiodide. A new and denser form of crystalline B has been deposited on Ta in the temperature range 800-1000 C from boron triiodide. Small portions of the deposit occur as red crystals with a density of 2.459 at 22.6°. The main impurity is 0.04% I. The red B is composed of units of nearly regular icosahedra in a slightly deformed cubic close packing. ***L. V. McCarty and D. R. Carpenter.*** *Electrochemical Society, Journal,* v. 107, Jan. 1960, p. 38-42.

4495 Fabrication, Properties, and Applications of Some Metallic Silicides. A great deal of interest has developed lately in the use of the so-called refractory metals Mo, W, Ta, and Nb for very high-temperature applications. If the atmosphere is oxidizing, these materials must be protected, and the possibility of coating each with its corresponding silicide is certainly an interesting one. $CrSi_2$ and $TiSi_2$ may find applications where the combination of high temperature stability and light weight are of interest. ***R. D. Grinthal.*** *Electrochemical Society, Journal,* v. 107, Jan. 1960, p. 59-61.

4496 Man, Metals and Modern Magic. A nontechnical discussion of the development of metals and alloys from prehistoric times to the modern era. ***J. Gordon Parr.*** 238 pp. 1958. American Society for Metals, Cleveland, and The Iowa State College Press, Ames, Iowa. (TN615 P24m)

4497* High-Temperature Alloys in the U.S.S.R. A general discussion. ***A. G. Guy.*** *Metal Progress,* v. 77, no. 1, Jan. 1960, p. 82-86.

4498 Low Pressure Metallurgy. A General Survey. The second in a series of three articles on vacuum metallurgy; the author here deals with cathodic sputtering and vacuum evaporation. ***A. S. Darling.*** *Metallurgia,* v. 60, Nov. 1959, p. 193-197.

4499 Metallurgy of the Rarer Metals. VI. Tantalum and Niobium. Describes the chemical processing of the metals from the decomposition of the ores to the separation and purification of the metals. The critical description of metal production covers all known processes, including those used industrially; those which have possibilities, and those of academic interest only. Description of the consolidation of the metals from the earliest work on sintering up to the latest arc-melting and electron bombardment techniques. Reactions of the metals with chemicals, gases and liquid metals are described as well as their physical and mechanical properties. While the main part of the text deals with the pure metals, the production of their alloys and more important compounds are described. The application of the metals, alloys and compounds, are catalogued in detail and include such important uses as Ta for electrolytic capacitors, TaC for hard metals and Nb for nuclear and high temperature application. ***G. L. Miller.*** 767 pp. 1959, Academic Press, New York. (TN798 M56)

4500* High-Temperature Research in Europe and Asia. A general discussion of research under way in England, France, Germany, Sweden, Norway, and Japan. *Metal Progress,* v. 77, no. 1, Jan. 1960, p. 92 + 6 pages.

4501 Physical Metallurgy. An up-to-date text which incorporates recent concepts such as dislocations, nucleation, radiation damage, etc., and develops its subject on the basis of atomic processes and interactions. Numerous references and problems. ***Bruce Chalmers.*** 467 pp. 1959. John Wiley & Sons, New York. (TN690 C35pm)

See also: **4247** (scrap metal economics).

METALS—CORROSION

4502 Corrosion in a Hydrocarbon Conversion System. Under some inexactly defined conditions, steels and alloys are attacked by atmospheres resulting from oxidation of hydrocarbon. In a fixed-bed catalytic system for dehydrogenation of butane the metal loss which contaminates the catalyst with a fine oxide dust causes undesirable side effects. The way in which the metal loss occurs is described and the effects of alloying agents on both laboratory tests and actual equipment are mentioned. ***F. A. Prange.*** *Corrosion,* v. 15, Dec. 1959, p. 13-15.

4503 Attack on Metals by Synthesis Gas From Methane-Oxygen Combustion. Severe metal wastage was experienced on AISI Type 347 (18Cr-8Ni-Nb) and AISI Type 310 (25Cr-20Ni) used in the construction of a gas generator in which methane was burned with O to produce CO and H for fuel synthesis of the Fischer-Tropsch type. The mode of attack varied with temperature. Typically attacked metal surfaces consisted of a semi-scale containing tiny globules of metallic particles surrounded by C or graphite interspersed with oxide. Tests with specimens of numerous steels and alloys installed at various locations in the reactor showed that the most resistant materials were those which best resisted carburization, that is, Ni, Monel, Inconel, AISI Type 446 (27 chrome-iron), Cu and pack-calorized materials. ***F. Eberle and R. D. Wylie.*** *Corrosion,* v. 15, Dec. 1959, p. 16-20.

4504 High Temperature Metal Deterioration in Atmospheres Containing Carbon-Monoxide and Hydrogen. Carbon steel and stainless steel equipment exposed to gas mixtures rich in H and CO at temperatures from 800 to 1200 F have been attacked with resulting loss of metal. Conditions under which this attack has been observed in a coal-to-oil synthesis plant and the nature of metal deterioration are described. Mechanism of this type attack is not fully understood although a possible gas-metal reaction is postulated. ***W. B. Hoyt and R. H. Caughey.*** *Corrosion,* v. 15, Dec. 1959, p. 21-24.

4505 Corrosion of Metals at Mandapam Camp, India. Monthly rates of corrosion of mild steel, Zn and Cu at two sites located 150 feet and 1350 feet from the sea are reported. Climatic conditions at the Mandapam Campsite are discussed as well as rates of corrosion of the test samples in relation to the observed climatic conditions. ***K. S. Rajagopalan, M. Sundaram, and P. L. Annamalai.*** *Corrosion,* v. 15, Dec. 1959, p. 25-28.

4506 The Formation of Porous Oxides on Metals. The porosity of the oxide scales formed on a number of metals during oxidation in dry O was investigated by measurements of specific surface and of density. The oxides formed during the linear oxidation of the eight metals: Ca, Pb, Mg, Nb, Th, W, and U are porous whereas those formed during the parabolic oxidation of Cu and Co are impervious to O gas. ***D. W. Aylmore, S. J. Gregg, and W. B. Jepson.*** *Electrochemical Society, Journal,* v. 106, Dec. 1959, p. 1010-1013.

4507 Aluminium Alloys for Water-Cooled Power Reactors. The corrosion properties of Al-Ni-Fe alloys in both static and dynamic high-temperature water are described. The properties are discussed in relation to water-cooled power reactors, and it is shown that at the present stage of development they are not competitive with Zr alloys for fuel sheathing. ***E. C. W. Perryman.*** *Institute of Metals, Journal,* v. 88, pt. 2; *Institute of Metals, Bulletin,* v. 5, pt. 2, Oct. 1959, p. 62-73.

4508* Oxidation in Air of Two Refractory Alloys (Miral D and Hastelloy X) at 900 and 1100° C. At 900 C, the surface oxidation rates of the two alloys are quite similar, but at 1100 C Nicral D oxidizes faster than Hastelloy X. On the other hand, after heating at 1100 C for 150 hours. Nicral D shows both intergranular oxidation and a small amount of internal oxidation, whereas Hastelloy X is especially subject to internal oxidation. Two descaling methods were compared: an electrolytic method, in a NaOH-Na_2Co_3 bath, and a chemical method using a $NaNo_3$-Na_2O_2 bath; the latter appears suitable only for Hastelloy X. *(In French.)* Oxydation a l'air de deux alliages refractaires (nicral d et hastelloy X) à 900 et 1100° C. ***J. Sannier, R. Dominget, and R. Darras.*** *Journal of Nuclear Materials,* v. 1, no. 3, Oct. 1959, p. 213-225.

4509* Hydrogen Absorption by Nickel Enriched Zircaloy-2. Specimens of Zircaloy-2 with varying Ni contents were exposed to autoclave corrosion, and also simultaneous corrosion and reactor irradiation in a hot water loop. Increasing the Ni

content of Zircaloy-2 (0.05 weight % Ni) to 0.75 weight % Ni caused a gross increase in H absorptivity, which resulted in embrittlement and severe loss of mechanical strength. ***W. Yeniscavich, R. A. Wolfe, and R. M. Lieberman.*** *Journal of Nuclear Materials*, v. 1, no. 3, Oct. 1959, p. 271-280.

4510* New Corrosion Tests for Plated Diecastings. The purpose of all accelerated corrosion tests is to assess the effectivity in normal service of electrodeposited coatings. Used are salt-spray, sulfur dioxide, accelerated acetic acid salt spray tests. The newest test is the "Corrodekote" test. The corrosive solution is composed of copper nitrate, ferric chloride, and ammonium chloride. *Metalworking Production*, v. 104, no. 2, Jan. 13, 1960, p. 69-70.

4511* Corrosion-Fatigue in Two Hot Work Die Steels. Two hot-work die steels, H21 and H23, were examined. It was found that sample life in the range of 1100 F to 1400 F was relatively independent of oxidation. Variations in heat treatments, test conditions or other material properties were found to affect sample life in direct proportion to their effect on the plastic strain imposed on the sample during cyclic loading. ***D. N. Williams, M. L. Kohn, R. M. Evans, and R. I. Jaffee.*** *Modern Castings*, v. 37, Jan. 1960, p. 19-25.

4512 Oxidation of Metallic Uranium. Uranium is oxidized according to a mechanism comparable to that of cerium. The initial layer of oxide, homogeneous and protective, grows and cracks up. The mass time curve, as registered on the thermobalance, changes from a parabolic to a linear type. ***J. Loriers.*** *U. S. Atomic Energy Commission, HW-61493*, Sept. 15, 1959, 8 pp. (UF767 Un3.1hw Contin.)

See also: **4083:** (anti-corrosion manual).

METALS—EXTRACTION AND REFINING

4513* Kinetic Factors in the Reduction of Silica From Blast-Furnace Type Slags. The rate of reduction is practically independent of stirring but is markedly accelerated by increased temperature. In a slag containing 45% SiO_2, 38% CaO, and 17% Al_2O_3 the energy of activation is approximately 130 kcal. ***James C. Fulton and John Chipman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 888-891.

4514 Progressive Instrumentation—One Key to a Better Future. Colorado Fuel and Iron Corporation's experience with automatic furnace reversals. ***Dan E. Brophy.*** *Blast Furnace and Steel Plant*, v. 48, Jan. 1960, p. 45-50.

4515 Basic Oxygen Steelmaking. The year 1959 has seen the basic O process establish an important position in the iron and steel industry as a commercial steel producing method. ***J. E. Tredennick.*** *Blast Furnace and Steel Plant*, v. 48, Jan. 1960, p. 51-57.

4516 Use of Oxygen Lances and Basic Brick in Open Hearth Furnace Roofs. ***H. A. Parker and Philip Schane, Jr.*** *Blast Furnace and Steel Plant*, v. 48, Jan. 1960, p. 68 + 9 pages.

4517 Some New Sponge Iron Processes. I. Critical evaluation and survey of current industrial-scale and pilot-scale sponge Fe processes for performance, economy, and possibility of further improvements. ***M. Wiberg.*** *Henry Brutcher Translation No.* 4615, 43 pp. (From *Jernkontoret Annaler*, v. 142, no. 6, 1958, p. 289-319.) Henry Brutcher, Altadena, Calif.

4518 Some Problems in Vacuum Arc Melting With a Consumable Electrode. ***D. A. Shabanov.*** *Henry Brutcher Translation No.* 4616, 12 pp. (From *Izv. VUZ, Chern, Met.*, no. 10, Oct. 1958, p. 37-42.) Henry Brutcher, Altadena, Calif.

4519 Ladle Desulfurization of Iron With Lime and Aluminum Suspended in a Gas. Development of pilot-scale equipment for desulfurizing hot metal with lime and Al suspended in air or N. ***S. K. Sobolev and G. N. Oiks.*** *Henry Brutcher Translation No.* 4623, 10 pp. (From *Izv. VUZ, Chern. Met.*, no. 11, Nov. 1958, p. 3-8.) Henry Brutcher, Altadena, Calif.

4520 Operation of Blast Furnace on Sized Fluxed Sinter. Search for new possibilities of lowering the coke rate in blast furnaces and overcoming the attendant difficulties from the lower permeability of the stock column and the greater nonuniformity in physical state of charge. ***S. K. Trekalo, N. M. Iakubtsiner and A. B. Shur.*** *Henry Brutcher Translation No.* 4664, 14 pp. (From *Metallurg*, no. 4, Apr. 1959, p. 3-7. Henry Brutcher, Altadena, Calif.

4521 Electric Furnace for Fluid-Bed Reduction of Iron Ores. A new economical smelting process for iron ores, based on fluidized-bed reactor technology. ***W. Wenzel.*** *Henry Brutcher Translation No.* 4679, 17 pp. (From *Stahl und Eisen*, v. 79, no. 17, 1959, p. 1183-1186.) Henry Brutcher, Altadena, Calif.

4522 Some Practical Aspects of Copper Refining in a Multiple System Tank House. ***M. A. Mosher.*** *Electrochemical Society, Journal*, v. 107, Jan. 1960, p. 7C-12C.

4523 Purification of $SiCl_4$ by Adsorption Techniques. Hydrogen reduction of this purified halide leads to higher purity Si than is obtainable otherwise. Data for the adsorption efficiency of various materials are presented using infrared spectroscopy and radioactive tracer techniques as the basis of comparison. ***H. C. Theuerer.*** *Electrochemical Society, Journal*, v. 107, Jan. 1960, p. 29-32.

4524 Purification of Tantalum Obtained by Vacuum Arc Melting. The purest commercially available Ta powder was consolidated by a single, vacuum, consumable-arc melting operation yielding ingots of considerably higher purity than the original powder. Interstitial and metallic impurity analyses are presented for a large number of heats made under consistent conditions of ingot and electrode size, arc current, and furnace pressure. The effect of C addition to an O-rich starting material was investigated, and the optimum C-O ratio for maximum refinement was located approximately. Under favorable conditions, the O content is reduced by approximately one order of magnitude. ***M. L. Torti.*** *Electrochemical Society, Journal*, v. 107, Jan. 1960, p. 33-35.

4525 Twenty-Five Years' Progress in Nickel Refining. While remaining basically unchanged, the carbonyl process for the refining of Ni has been improved to a remarkable extent during the last 25 years. *Industrial Chemist*, v. 35, Dec. 1959, p. 583-588.

4526 Sponge Iron in Mexico. In the past few years, Hojalata y Lámina's plant in Monterrey has produced over 110,000 tons of sponge iron. This gaseous reduction process (termed HyL) produces material which is virtually free from residual elements and makes an excellent electric furnace charge. ***Gunther H. Muller.*** *Metal Progress*, v. 77, no. 1, Jan. 1960, p. 111-115.

4527* Vacuum Treatment of Molten Steel in Germany. Developed by Dortmund-Hörder Hüttenunion, this process is applicable to electric furnace, openhearth and oxygen converter production. It operates on the basic principle of forcing successive portions of liquid steel into a vacuum vessel by atmospheric pressure. A variety of controlled alloy additions can be made late in the degassing cycle. This feature, combined with a major reduction of O content, leads to improved cleanliness and increased product yield. ***P. J. Wooding and W. Sieckman.*** *Metal Progress*, v. 77, no. 1, Jan. 1960, p. 116-122.

4528* Slag Explosions in Open-Hearth Steelworks. Dangers of slag cooling by water; processes of slag disposal; protection of labor during the disposal of slag. *(In German.)* Schlackenexplosionen in Siemens-Martin-Stahlwerken. ***Hermann Tetzner.*** *Neue Hütte*, v. 4, June 1959, p. 352-359.

4529 Factors Affecting Yield and Metal Quality in the Reduction of UF_4 to Metal. A study was made to determine the factors which affect yields and metal quality in the bomb reduction of green salt (uranium fluoride) with Mg to produce massive U. Under the conditions of the test, Mg excess had

the greatest effect on crude yields. ***Orville R. Magoteaux and Clarence C. Smitherman.*** *U. S. Atomic Energy Commission, NLCO-794,* Feb. 18, 1959, 23 pp. (UF767 Un3.1nL Contin.)

See also: **4238** (effects of O on world steelmaking).

METALS—FINISHING, POLISHING, AND CLEANING

4530 Progress in Polishing. I.M.F. Symposium Report. On Nov. 16th the London Branch of the Institute of Metal Finishing held a Symposium on the subject of Progress in Polishing. The four papers summarized herein are entitled "Recent Developments in the Field of Barrel Finishing" by C. J. Kellard; "Chemical and Electrolytic Polishing" by F. H. Wells; "Some Aspects on the Use of Liquid Polishing Compounds" by S. J. Scouse; "Progress in Machine Polishing" by J. H. Bryan and J. P. Dewar. No information is given as to date and source for full publication of these papers. ***C. J. Kellard.*** *Electroplating and Metal Finishing,* v. 12, Dec. 1959, p. 456-461.

4531* Machine Polishes 40ft. Tubes Internally. Producing a polished finish in the bore of stainless steel tubing has hitherto presented problems which made it a slow process. The situation has undergone a drastic change through the development by Brookes (Oldbury) Ltd. of a machine which polishes the interior of long tubes in 6½ to 8% of the time taken by the methods formerly used. *Metalworking Production,* v. 104, no. 2, Jan. 13, 1960, p. 62-63.

METALS—FOUNDRY PRACTICE

4532* Modern Methods of Slag Analysis. A method is proposed for analysis of cupola slags which enables a complete and accurate analysis for seven major constituents to be carried out in three to four hours. ***W. E. Clarke.*** *B.C.I.R.A. Journal of Research and Development,* v. 7, no. 15, Dec. 1959, p. 867-875.

4533 Permanent Mold Castings. A continuing search for efficient methods of producing Al permanent mold castings has led to the development of continuous melting furnaces, automatic pouring, and turntable-mounted molds. ***Jack C. Miske.*** *Foundry,* v. 87, Jan. 1960, p. 66-71.

4534 Risering Copper Alloy Castings. Modes of freezing and effect of alloying are discussed in relation to the feeding of Cu alloy castings. Determining riser size, shape, and feeding range are covered for groups of alloys. ***R. W. Ruddle.*** *Foundry,* v. 87, Jan. 1960, p. 78-83.

4535 Uranium Foundry Practice. In addition to its fission-sustaining characteristics, U is a uniquely high-strength, high-density material. U castings may be used in nuclear-powered space ships. ***G. D. Chandley and D. G. Flack.*** *Foundry,* v. 88, Feb. 1960, p. 76-79.

4536 Mold and Core Inspection. Higher quality castings begin with inspection in the mold and core departments. Ohio Steel Foundry reduced cleaning costs from 33 to 20% of total shop costs through core and mold inspection. ***J. W. Gillespie.*** *Foundry,* v. 88, Feb. 1960, p. 80-83.

4537 An Unconventional Approach to Diecasting Production. Zn and Al diecastings are produced in a wide range of sizes on 400- and 600-ton machines. Unit dies are used extensively, and other features include continuous melting and conveyorized handling. ***Jack C. Miske.*** *Foundry,* v. 88, Feb. 1960, p. 84-87.

4538 Practical Tips on Cupola Control. Data show how cupola reactions can be controlled and how consistent results can be obtained reasonably well. ***Sam F. Carter.*** *Foundry,* v. 88, Feb. 1960, p. 88-95.

4539 Factors to Consider in Producing Shell Cores. Characteristics of the two basic types of resin binders and their relationship to types of shell cores and coremaking machines, mix formulations, corebox design, and casting defects. ***R. S. L. Andrews.*** *Foundry,* v. 88, Feb. 1960, p. 96-100.

4540 Gating of Ductile Iron Castings. Discussion of the gating to produce quality ductile Fe castings, with some explanation of the fundamental characteristics of ductile Fe. ***R. W. White.*** *Foundry,* v. 88, Feb. 1960, p. 101-107.

4541 Mould Density and Mechanical Properties of Cast Alloys. Mold-ramming density may have considerable influence on the mechanical properties of many cast alloys. ***R. A. Jones and V. Kondic.*** *Foundry Trade Journal,* v. 108, Jan. 7, 1960, p. 3-7.

4542 "Waste" Heat in Foudries. Considerable amounts of heat are normally wasted in a variety of foundry operations. Although potential savings of heat are fairly obvious, there is little documentary evidence that any heat-conservation schemes have in fact been put into practice. *Foundry Trade Journal,* v. 108, Jan. 7, 1960, p. 9-10.

4543 Investment-Casting of Precious Metals. The author considers techniques used in dental and jewelry castings and suggests applications of a wider scope. ***P. E. Gainsbury.*** *Foundry Trade Journal,* v. 108, Jan. 7, 1960, p. 11-19.

4544* Steel Castings for High Duty. Brief description of equipment installed at a leading Swiss foundry and the manufacturing and control methods for making steel castings for especially severe services. ***Hans E. Hübscher.*** *Metal Progress,* v. 77, no. 1, Jan. 1960, p. 77-81.

4545* Diecaster Design Simplifies Service. Cold-chamber diecasting machines from a range having clamping pressures of 60 to 800 tons, and gooseneck models covering from 60 to 200 tons, were shown at the Sixth European Machine Tool Exhibition by J. Fries Sohn, Frankfurt-am-Main, West Germany. The machines were notable for their novel injection mechanism. *Metalworking Production,* v. 104, no. 2, Jan. 13, 1960, p. 68-69.

4546* Controlling Costs of Foundry Operations. Management should inform its foremen of the goals of a cost control system in a positive manner, and in a language understandable from their point of view. This over-all approach to the problem of cost control, and how it can be related to the individual operations in the foundry, is presented. ***K. T. Rinderle.*** *Modern Castings,* v. 37, Jan. 1960, p. 13-16.

4547* Parashrinkage Phenomena-Veining, Metal Penetration, Scabbing, Hot Tearing. Hot spots are composed of two parts in several surface-type casting defects—a volume of molded sand, and a volume of liquid at the thermal center. These are separated from each other by the mold-metal interface. Within the thermal center, shrinkage develops. Shrinkage derivatives, veining, metal penetration, and possibly scabbing may develop because of unsatisfactory melt quality within the thermal center. Separating the thermal center from the hot-spot location involves altering of isothermal lines during metal solidification. ***D. C. Williams.*** *Modern Castings,* v. 37, Jan. 1960, p. 17-18.

4548* Solidification of Aluminum Casting Alloys. The manner in which several Al alloys solidify was investigated. The grain size for all alloys investigated was established in the early stages of solidification. The compact dendrite form of the solid-solution alloys apparently contributed to slightly smaller grain sizes for these alloys. For the same solidification rate, constituents which formed near the liquidus tended to be larger than constituents which formed near the solidus. ***R. E. Spear and G. R. Gardner.*** *Modern Castings,* v. 37, Jan. 1960, p. 36-44.

4549* Hot Tears in Steel Castings. Foundryman can control most hot tears by careful placement of heads, chills, and gates on castings of rational design; and following step by step the variety of well-known molding precautions. ***Michael A. Notte.*** *Modern Castings,* v. 37, Feb. 1960, p. 35-37.

4550* Hot Properties of Molding Sand. Problems of hot strength, of a minimum expansion and of high hot deformation are discussed. ***A. G. Johnston.*** *Modern Castings,* v. 37, Feb. 1960, p. 38-40.

4551* How Can Foundrymen Reduce the Time and Cost of Evaluating the Quality of Their Magnesium Castings? By greater use of metallographic inspection of critical sections in castings, thereby reducing the number of mechanical tests needed for final acceptance. ***J. W. Meier.*** *Modern Castings,* v. 37, Feb. 1960, p. 44-50.

4552* Apparent Thermal Conductivity of Molding Sand at Elevated Temperatures. The experimental curve of the apparent thermal conductivity of a synthetic silica molding sand versus temperature exhibited certain pronounced characteristics: (1) A decreasing conductivity with increasing temperature below 1100 F (593 C). (2) A shallow minimum between 1100 and 1500 F (593-815 C). (3) A sharply rising conductivity with increasing temperature above 1500 F (815 C). ***D. H. Whitmore and Q. F. Ingerson.*** *Modern Castings,* v. 37, Feb. 1960, p. 49-57.

4553* Surface Defects on Shell Molded Castings. Types of surface defects on steel castings made in shell molds were studied in order to isolate and define the defect which is peculiar to shell molds. The defect was found to be a surface accumulation of oxides and associated gas. Cause of the defect was proven to be the oxygen in the phenol formaldehyde shell resin. Cures are suggested. ***J. A. Behring and R. W. Heine.*** *Modern Castings,* v. 37, Feb. 1960, p. 58-66.

4554* Measurement vs. Calculation of Solidification of Metal in Iron Molds. Tests were made on double-poured iron roll castings, and several methods of calculation were tried before a new method was developed. A practical result of the project was the development of a simple means for telling when the second part of a pour of a double-poured roll should be started in order to produce an alloyed shell of the depth of thickness desired. ***J. D. Keller and N. R. Arant.*** *Modern Castings,* v. 37, Feb. 1960, p. 71-80.

METALS—HEAT TREATMENT

4555* Tendency of Overheated Steel to Reversible Tempering Brittleness in Consequence of the Thermal Treatment Conditions After Secondary Austenitizing. The tempering conditions were beyond normal as regards temperature. The steel used contained 0.25% C, 1.07% Si, 1.17% Mn, and 1.33% Cr. The specimens were annealed first from 1200 C during one hour. The second annealing process was carried out at 850, 900, and 1000 C above and below Chernoy's b point. Tempering was made at 500, 600, and 700 C for one hour with subsequent cooling of the specimen in water and in the furnace. (*In Rumanian.*) Susceptibilitatea otelului supraîncălzit la fragilitatea reversibilă de revenire în functie de conditile tratamentului termic după austenitizarea secundară. ***Butu Rotenstein and Nicolae Drăgan.*** *Academia Republicii Populare Romine, Centrul de Cercetări Metalurgice, Studii şi Cercetări de Metalurgie,* v. 4, no. 2, 1959, p. 127-138 + 3 plates.

4556* The Origin of Flake Graphite Formed During High Temperature Heat Treatment of White Cast Iron. It is shown that normal flake and undercooled graphite cannot form as the result of decomposition of cementite in the solid state, and that compact or quasi-flake graphite ensues from the decomposition of eutectic carbide in the solid. Heat treatment of ledeburite below its equilibrium freezing temperature results in a quasi-flake graphite structure not found in normal grey irons. Above this temperature but below the melting point of the iron-graphite eutectic, it is possible to detect in quenched specimens the melting of ledeburite and simultaneous formation of a normal graphite structure. In the experiments reported, fine or under-cooled graphite formed on heat treatment of ledeburite only in irons of very low sulphur content, and again when melting had taken place. ***W. Oldfield.*** *B.C.I.R.A. Journal of Research and Development,* v. 7, no. 15, Dec. 1959, p. 844-852 + 6 plates.

4557* One Furnace—Two Quenches. A single "two-headed" furnace designed for service in overseas plant of an American hacksaw-blade manufacturer is capable of bright-hardening two different types of tool steels. ***Carl G. Paulson.*** *Machinery (New York),* v. 66, no. 6, Feb. 1960, p. 131-132.

4558 Vertical Cylindrical Closed Quench Furnace. New Equipment for Gas Carburising and Carbonitriding. *Metallurgia,* v. 60, Nov. 1959, p. 192.

See also: **4581** (heat treatment of Ti alloy); **4582** (heat treatment of Ti alloy).

METALS—MECHANICAL AND PHYSICAL PROPERTIES

4559* Materials in Rolling Element Bearings for Normal and Elevated (450°F) Temperature. Improvement in life of bearings made of vacuum-melted steels does not appear to be commensurate with the improvement in cleanliness. This is regarded as confirming evidence to a long-held view that cleanliness is not the only factor involved in the fatigue property of steel. Fatigue studies were made of both 52100 and high temperature steels. Bearing ratings range from 17% less than the AFBMA basic load rating to 23% greater than this rating for vacuum-melted 52100 steel. In a test of vacuum-melted tool steel (M-1), the bearing load rating was 22% greater than the basic load rating for 52100 steel. ***T. W. Morrison. H. O. Walp, and R. P. Remorenko.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 129-146.

4560* Fatigue and Dynamic Creep Properties of 13 Cr Steel at Elevated Temperatures Under Combined Stresses of Static Tension and Alternating Bending. Simulated service condition tests were made at an elevated temperature of 450 C. The frequency of alternating bending stress was 780 c.p.m. and the test period was 0.2 to 200 hours. The results indicate: (1) Alternating bending stress superimposed on static tensile stress reduces the fatigue life. (2) Alternating bending stress which is combined with static tensile stress does not always increase creep strain. In the range of small stress ratio (alternating bending stress divided by static stress), alternating bending stress blocks the increase in creep strain. (3) The decrease in creep strain caused by alternating bending stress is explained by the hardening effect due to stress alternation. ***Shuji Taira, Ryoichi Koterazawa, and Mutsuo Inoue.*** *Bulletin of JSME,* v. 2, no. 8, Nov. 1959, p. 508-513.

4561* Creep of Mild Steel Under Periodic Stresses of Rectangular Wave-Shape. Creep tests were made with 0.14% C steel at 450 C under periodic stresses, changing stepwise between two stress levels, the means of which was 17.0 kg/mm^2 and the stress amplitude of which was 1.0 or 2.0 kg/mm^2. It was found that creep strain under varying stresses could be predicted from the data of constant stress creep tests by applying the concept of the "mechanical equation of state of a solid" with an error not exceeding 10%. ***Shuji Taira, Kichinosuke Tanaka, Kiyotsugu Ohji, and Isao Harumoto.*** *Bulletin of JSME,* v. 2, no. 8, Nov. 1959, p. 514-520.

4562 Embrittlement of High Strength Steels. ***E. P. Klier.*** Paper from "High Strength Steels for Aircraft", American Society for Metals, Cleveland. p. 53-67. (TL699.S8 S89h)

4563 The Effect of Hydrogen in Quantities of Up to 0.009% on the Room-Temperature Izod and Tensile Strength of Commercially Pure Titanium. Tests on slowly cooled bars of Ti indicated that the Izod strength progressively increased as the H content was reduced from 0.009 to 0.001%. H and O atoms had approximately equivalent deleterious effects on the impact strength of Ti. The tensile strength increased when the straining rate was changed from the slowest to the fastest available; this increase was independent of the H content and also of the cooling rate. ***R. H. Beton.*** *Institute of Metals, Journal,* v. 88, pt. 2; *Institute of Metals, Bulletin,* v. 5, pt. 5, Oct. 1959, p. 93-95.

4564 Magnetization of the Compound TiFe. Magnetization curves were determined for the CsCl-type compound TiFe at six

temperatures ranging from 9 to 110 K. The curves show a saturation effect at high field strength but they are of a form that is not characteristic of ferromagnetism. A saturation magnetization of 3.30 ± 0.07 cgs units per gram was derived from the high field data. ***M. V. Nevitt.*** *Journal of Applied Physics,* v. 31, Jan. 1960, p. 155-157.

4565 Magnetic Properties of Metals and Alloys. Fundamental questions in magnetism; experimental measurement of fundamental magnetic properties; magnetic domain structures; nuclear magnetic resonance in magnetic crystals; metallurgical structure and magnetic properties; magnetic measurements in metallurgy; magnetic properties of thin films and of fine particles. ***R. M. Bozorth, et al.*** 349 pp. 1959. American Society for Metals, Cleveland. (QC761 Am35m)

4566 Mechanism of Evolution of Gases From Liquid Metal Under Vacuum. ***A. M. Samarin and R. A. Karasev.*** Paper from "American Vacuum Society, Inc., 1958, Vacuum Symposium Transactions", Pergamon Press, New York. 1959, p. 35-37. (QC166 C73v Over.)

4567* Solid-Fuel Rocket Chambers for Operation at 240,000 Psi. and Above. II. A high-strength steel rocket chamber failed unexpectedly during a hydrostatic test; water used in hydrostatic testing proved to be responsible, causing delayed, H-induced fracture. An investigation showed that solid-fuel rocket cases with tangential stresses of 240,000 psi. are practical. Stresses of 260,000 psi. appear possible if small plastic strains can be tolerated. ***M. E. Shank, C. E. Spaeth, V. W. Cooke, and J. E. Coyne.*** *Metal Progress,* v. 76, no. 6, Dec. 1959, p. 84-92.

4568 The Behaviour of Fine Copper-Nickel Alloy Wires With Negative Temperature Coefficients of Resistance. Heat treatment had a pronounced effect upon the electrical resistance and the temperature coefficients of resistance of the wires; continuous change of resistance occurred at temperatures above 500 F. ***W. Wiebe.*** *National Research Council of Canada, Mechanical Engineering Report,* MS-100, 25 pp. (TJ1 N21.5m Contin.)

4569* Properties of Uranium Monocarbide. Specimens of UC of nearly theoretical density were prepared by arc melting and casting. Physical property measurements of the unirradiated materials included hardness, density, electrical resistivity, thermal conductivity, linear expansion, modulus of elasticity, and compatibility with NaK and stainless steel. One group of specimens was irradiated in the MTR to a burnup of 1400 Mwd/ton of U. Swelling was found to be in the range of 0.66 to 2.53%. Fission recoil from the surface of the specimens could account for the observed gas release. ***C. A. Smith and Frank Rough.*** *Nuclear Science and Engineering,* v. 6, Nov. 1959, p. 391-395.

4570 On a New Mode of Deformation in Indium Antimonide. Dislocations can be introduced into InSb by local impact. The particular configuration of dislocations produced has been called a "dislocation crack", because of its close resemblance in macroscopic features to an ordinary crack. The stress required to produce a dislocation crack is shown to be of the same order as the fracture stress. A mechanism which explains the observations is proposed. Dislocation cracks also occur in InAs, GaAs, GaP, and Ge. ***J. W. Allen.*** *Philosophical Magazine,* v. 4, ser. 8, Sept. 1959, p. 1046-1054.

4571 Specific Heats of Dilute Alloys of Manganese in Silver and Copper at Low Temperatures and in Magnetic Fields. Investigation of the specific heats of three Ag-Mn and of one Cu-Mn alloy in the region of 1.3 to 20 K. Measurements were also carried out in magnetic fields of 5, 8.6, and 14 kOe. The C/T versus T-curves show a maximum at low temperatures. This peak shifts to higher temperatures with increase in concentration. ***J. De Nobel and F. J. Du Chatenier.*** *Physica,* v. 25, Oct. 1959, p. 969-979.

4572 The Resistivity of Ordered Au_3Cu. The influence of order on the resistivity of Au_3Cu was measured at −195 C. Long range order is formed in Au_3Cu below 200 ± 3 C. Above this temperature only short range order can appear. Short range order causes an increase in the resistivity; long range order a decrease. Complete ordering at 80 C decreases the resistivity measured at −195 C to 40% of the initial value. ***B. M. Korevaar.*** *Physica,* v. 25, Oct. 1959, p. 1021-1032.

4573 Isotope Effect in the Bardeen-Cooper-Schrieffer and Bogoliubov Theories of Superconductivity. It is shown that the Bardeen-Cooper-Schrieffer and Bogoliubov theories of superconductivity predict an isotope effect which is the same for all superconductors, so long as the Coulomb interaction is neglected. This is demonstrated by writing the system of integral equations in a mass-invariant form, and it does not involve finding actual solutions. ***James C. Swihart.*** *Physical Review,* v. 116, 2nd ser., no. 1, Oct. 1, 1959, p. 45-52.

4574 Frequency Dependence of the Surface Resistance of Superconducting Tin in the Millimeter Wavelength Region. ***R. Kaplan, A. H. Nethercot, Jr., and H. A. Boorse.*** *Physical Review,* v. 116, 2nd ser., no. 2, Oct. 15, 1959, p. 270-279.

4575 Effects of Electron Correlation on the Optical Properties of Metals. Many-body perturbation theory is used to determine the effect of electron-electron correlation on the optical properties of metals. The formula for the current induced in such a system by an electromagnetic wave is written in such a form that it may be conveniently evaluated with diagrammatic techniques. Lowest order diagrams give the usual conductivity of a noninteracting electron gas. First order (in the Coulomb field) diagrams are typical of the random phase approximation and do not appreciably influence the conductivity. ***P. A. Wolff.*** *Physical Review,* v. 116, 2nd ser., no. 3, Nov. 1, 1959, p. 544-554.

4576 Nordheim's Theory of the Resistivity of Alloys. Nordheim's theory is extended to account for ionic potentials that extend outside the unit cell, and order of any range. It is shown that the original theory is less approximate than is generally asserted. As an incidental result, it is also shown that Flinn's electronic theory of order can be extended appreciably. ***George L. Hall.*** *Physical Review,* v. 116, 2nd ser., no. 3, Nov. 1, 1959, p. 604-605.

4577 Resistance Transitions in Superconducting Tantalum. A study was made of the superconducting to normal transition in outgassed Ta wires induced by the application of an external longitudinal magnetic field. It was found that in most cases the transition, as determined from resistance measurements, consisted of an almost discontinuous appearance of resistance; followed by a rather gradual rise in resistance until the full residual resistance was restored. ***D. P. Seraphim and R. A. Connell.*** *Physical Review,* v. 116, 2nd ser., no. 3, Nov. 1, 1959, p. 606-612.

4578 Magnetic Susceptibility Balance Using a Null Technique. Describes a very sensitive magnetic susceptibility balance with the characteristic of providing a null reading over all field strengths whenever the sample is purely paramagnetic. The balance is used mainly for single crystal measurements of susceptibility at high and low temperatures. Any ferromagnetic impurity shows as a null deviation as the magnetic field strength is altered. ***J. R. Singer.*** *Review of Scientific Instruments,* v. 30, Dec. 1959, p. 1123-1124.

4579 Short-Time High-Temperature Testing. Proceedings of the symposium presented by the ASM during the Tenth Metal Congress and Exposition, Los Angeles, March 25 to 29, 1957. Papers cover strength of metals undergoing rapid heating, the fluid analogy to aerodynamic heating, short-time creep of structural sheet metals, effect of holding time and strain rate on the tensile properties of structural metals, and a programming universal elevated-temperature testing machine. 137 pp. 1958. American Society for Metals, Cleveland. (TA460 Sy68s)

4580 Some Properties of Vacuum-Treated Bessemer Steel. The use of vacuum to lower the content of gases and S in Bessemer steel considerably improves the mechanical properties of this steel, making it possible to extend pneumatic methods of steel-making considerably. ***A. M. Samarin.*** Paper from "American Vacuum Society, Inc., 1958, Vacuum Symposium Transactions", Pergamon Press, New York. 1959, p. 198-203. (QC166 C73v Over.)

4581* Properties and Thermal Treatment of the Titanium Alloy TiA17Mo4. In the annealed state, strengths between 104 and 124 kp/mm² were found. The effect of deformation on the tensile strength, the effect of the final deformation, and the deformation temperature on the ductility, are higher than the effect of small changes of the alloy composition in the concentration range examined. The physical properties can be raised by thermal treatment. *(In German.)* Eigenschaften und Wärmebehandlung der Titanlegierung TiAl7Mo4. ***W. Knorr.*** *Technische Mitteilungen Krupp*, v. 17, no. 3, Sept. 1959, p. 111-123.

4582* Investigations of the Titanium Alloy TiMo6A13. The mechanical properties of a Ti alloy with 6% Mo and 3% Al with different thermal treatments, and its precipitation hardening behavior, were examined. After quenching from 800 C the alloy has a minimum hardness and yield. During tempering at 400 C, hardness and strength are maximum, whereas ductility is very low. During tempering between 450 and 600 C, a satisfactory combination of strength and ductility is obtained. *(In German.)* Untersuchungen an der Titanlegierung TiMo6A13. ***W. Knorr.*** *Technische Mitteilungen Krupp*, v. 17, no. 3, Sept. 1959, p. 124-129.

4583* The Evaluation of Residual Stresses. Stresses extending in two or more directions in the macroscopic field and involving many grains in polycrystals were found to have harmful effects. Residual stresses today cannot be fully determined by means of non-destructive methods, yet in most cases it has been possible to evaluate the effect of stresses of this type. Prevention is based on design and selection of material. *(In German.)* Die Bewertung innerer Spannungen für die Praxis. ***E. Houdremont and H. Scholl.*** *Technische Mitteilungen Krupp*, v. 17, no. 3, Sept. 1959, p. 153-155.

4584* Patterns and Magnetization Curves of Iron-Silicon Checkered-Pattern Metal Sheet. A study showing how heterogeneously oriented crystallites decrease the magnetic quality of this type of metal sheet. *(In German.)* Texturen und Magnetisierungskurven von Eisen-Silizium-Würfeltexturblechen. ***H. S. Stäblein.*** *Technische Mitteilungen Krupp*, v. 17, no. 3, Sept. 1959, p. 159-161.

4585 The Evaporation of Various Alloys at High Temperature *in vacuo*. The rates of evaporation of alloys at elevated temperatures in vacuum are dependent upon the temperature only when the pressure is less than 100 μ. Coupons of materials intended for use in vacuum-furnace construction were subjected to temperatures up to 2280 F in vacuums of 0.1-10μ. Rates of evaporation range from 4.7×10^{-2} for 80 Ni-20 Cr to 1.2×10^{-2} g/cm²hr for type 430 stainless steel. All alloys tested roughly follow the rule that a 10% increase in temperature causes a one-decade increase in evaporation rate. ***W. A. Blonn.*** Paper from "American Vacuum Society, Inc., 1958, Vacuum Symposium Transactions", Pergamon Press, New York. 1959, p. 30-34. (QC166 C73v Over.)

4586 Materials-Property-Design Criteria for Metals. VIII. The Creep Behavior of Selected Materials in the Range Up to 1% Net Creep Strain and 1000 Hours. Objectives were to compile and evaluate creep strain versus time data on airframe structural materials. The range of interest, as recommended by the Elevated Temperature Task Group of the ANC-5 Panel, includes creep strain up to 1% and time up to 1000 hr. Only two reference sources dealt with creep of airframe structural materials within the conditions of strain and time imposed. Although both of these sources have considerably extended the knowledge of creep behavior in the early stages of creep, it appears that neither has encompassed adequately the regions of interest specified. ***R. J. Favor, W. P. Achbach, and H. J. Grover.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report*, 55-150, Sept. 1959, 23 pp. (TL507 Un3.18w Vis.)

4587 Development of a Fatigue Testing Apparatus for Testing Honeycomb Sandwich Structural Panels in Service-Simulated Sonic Fatigue. Indicates the need of a 200,000-v. AC generator to simulate electrostatic fields of approximately 400,000 v/cm, and that the medium surrounding the test specimen must be changed to prevent corona discharge. For this purpose sulfur hexafluoride at 9 to 10 atmospheres may be utilized. The design of a 200,000-v. AC generator is complicated and expensive. Recommends an alternative procedure to accomplish the same objectives. ***Edmond F. E. Zeijdel and William H. Ashley.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-231, Sept. 1959, 33 pp. (TL507 Un3.18w Vis.)

4588 Statistical Evaluation of Data From Fatigue and Creep-Rupture Tests. I. Fundamental Concepts and General Methods. Fatigue tests are classified into three types with consideration of appropriate method of evaluating the data. Fundamental statistical concepts, general methods, and useful tools are presented. The possibilities of estimating distribution parameters are examined. General principles of fitting curves to observations are outlined and applied to the methods of maximum likelihood, linear regression, and best linear estimators. ***Waloddi Weibull.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-400, Sept. 1959, 73 pp. (TL507 Un3.18w Vis.)

4589 Observations on Creep of Tantalum. The average value of the activation energy for Ta is 109,600 cal./gm. mole. The average value of the stress parameter determined from four tests is 5.65×10^{-4} in.²/lb. The value of the stress parameter determined from a plot of the Zener-Holloman parameter vs. stress is 5.81×10^{-4} in.²/lb. The second stage of creep (constant creep rate) lasts only a few hours. ***Glenn Murphy and Robert E. Uhrig.*** *U. S. Atomic Energy Commission, IS-26*, Aug. 1959, 30 pp. (UF767 Un3.1isu Contin.)

4590 The Density of Liquid Plutonium Metal. Measurements were made of the product of surface tension and the contact angle of liquid Pu vs. solid Ta and of the density of liquid Pu as functions of temperature between 655 and 960 C. ***C. E. Olsen, T. A. Sandenaw and C. C. Herrick.*** *U. S. Atomic Energy Commission, LA-2358*, Dec. 18, 1959, 17 pp. (UF767 U3La Contin.)

4591 Mechanical Properties of Some Heat-Resistant Metal Honeycomb Cores. Presents the results of tests of commercially produced heat-resistant metal honeycomb cores for use in structural sandwich construction. Cores tested were made of four corrosion-resistant steels, a Ni-Cr alloy, and Ti. Properties evaluated were compressive strength at normal and elevated temperatures and shear properties at normal temperatures. Detailed descriptions of core materials and testing procedures are given. ***Edward W. Kuenzi and W. E. Jahnke.*** *U. S. Forest Products Laboratory Report No.* 1872, Dec. 1959, 28 pp. (TS800 Un3.3r Contin.)

4592 Thermal Fatigue of Ductile Materials. III. Behavior of Crucible 422 Steel. Effect of constrained and free thermal cycling on the subsequent stress-rupture life. Specimens were alternately heated and cooled through a maximum cycle temperature from 1000 to 1500 F and a minimum cycle temperature of 200 F, both with and without constraint. The number of cycles to failure, changes in hardness and microstructure, and stress-rupture properties were studied as a function of the conditions of thermal cycling. Changes in stress-rupture behavior were judged on the basis of the life at 1100 F and 46,000 psi. ***Francis J. Clauss.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA, TN-D-69*, Oct. 1959, 23 pp. (TL570 Un3t Vis.)

4593 Rotating-Beam Fatigue Tests of Notched and Unnotched 7075-T6 Aluminum-Alloy Specimens Under Stresses of Constant and Varying Amplitudes. Static mechanical properties and constant-amplitude fatigue tests of unnotched specimens yielded results higher than average for the material. Fatigue tests of notched specimens indicated the material was more notch sensitive than indicated by other data. ***Herbert F. Hardrath, Elmer C. Utley, and David E. Guthrie.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-210*, Dec. 1959, 34 pp. (TL570 Un3t Vis.)

4594 Axial-Load Fatigue Tests of 2024-T3 and 7075-T6 Aluminum-Alloy Sheet Specimens Under Constant- and Variable-Amplitude Loads. The variable-amplitude test data were analyzed assuming linear cumulative damage, and a limited statistical analysis was used to confirm conclusions. The value of the summation of cycle ratios was found to vary with material, loading sequence, and mean stress. ***Eugene C. Naumann, Herbert F. Hardrath, and David E. Guthrie.*** *U. S. National Aeronautics and Space Administration, Technical*

Note, NASA *TN*-D-212, Dec. 1959, 37 pp. (TL570 Un3t Vis.)

4595 Fatigue Damage During Complex Stress Histories. The relation between fatigue life and the relative number and amplitude of imposed cycles of stress was determined in wire specimens of 2024-T4 and 7075-T6 aluminum alloys and hard drawn steel. ***H. W. Liu and H. T. Corten.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-256*, Nov. 1959, 56 pp. (TL570 Un3t Vis.)

See also: **3764** (ultrashort – time properties of structural alloys); **4614** (magnetic properties of metals); **4615** (hardness of oxygen-free copper); **4619** (fatigue of Cu).

METALS—MECHANICAL WORKING

4596 Coated Abrasives—Modern Tool of Industry. Describes how abrasives are manufactured, and their use in the metalworking (ferrous and nonferrous), woodworking, glass, and plastics industries, in applications ranging from heavy material removal to fine polishing. Also describes recent advances, including new automatic machinery, applications such as strip scouring, preplate finishing, contour finishing, and discusses such special topics as cutting oils, coolants, and lubricants specifically for use with coated abrasives. ***Harold B. Maynard, editor.*** 426 pp. 1958. McGraw-Hill, New York. (TJ1296 C63c)

4597 Digital Computer Runs Hot Plate Mill. Description of new 140-in. four-high slabbing mill in the Lukens works at Coatesville, Pa. A transistorized digital computer calculates screwdown settings from initial openings, limits, and draft information punched in by the operator. The whole rolling schedule is computer programmed, except for the turn-around after the intermediate limit. ***Cliff Burdick.*** *Control Engineering*, v. 7, Jan. 1960, p. 126-130.

4598 The Machining of Reactor Materials. For cladding U fuel elements, Zircaloy-2 may be in tubular shapes or in the form of plates with recesses or pockets. An Al-Ni alloy, designated X-8001 does not seriously absorb or interfere with neutrons generated in the reactor, so that it can be used advantageously as a cladding material for fuel elements. Natural U and U-Nb alloys can be handled under standard health and safety considerations for U-fuel fabrication facilities. The swarf in machining some types of graphite material at higher speeds is in the form of finely divided particles appearing as a black, pervading fog. Adequate suction devices near the cut are necessary in such cases. Radiation hazards associated with the machining of U metal and its alloys are much less severe than those associated with Pu. In general, a "safe mass", which is less than half the critical mass, will be the basis for fabrication operations. ***A. O. Schmidt, B. L. Richardson, and J. R. Roubik.*** *Engineers' Digest*, v. 20, Dec. 1959, p. 497 + 6 pages.

4599 Investigations Into the Effectiveness of Compensating Thermo-Electric Currents for Reducing Cutting-Tool Wear. Although the tests were carried out under laboratory conditions, they did not show any noticeable improvement in tool life. It appears that the method of reducing tool wear by compensation of thermo-electric currents is of no practical importance. ***G. Engstrand.*** *Engineers' Digest*, v. 20, Dec. 1959, p. 507-509. (Translated from *Transactions of the Royal Institute of Technology, Stockholm.*)

4600 Automatic Machining Line for Spur Gears. In the construction of Russian automatic production lines, there is a distinct tendency towards those lines which can readily be retooled for the manufacture of components of different design and dimensions. An example of this trend is a line for the automatic machining of spur gears. Details are discussed. ***U. N. Pisarev and E. Kh. Reuterstein.*** *Engineers' Digest*, v. 20, Dec. 1959, p. 509-510. (Translated from *Traktori i Selkhozmashini.*)

4601 The Manufacture of Bar, Rod, and Wire-Rod in Copper and Copper-Base Alloys. A Comparison Between Extrusion and Other Methods. ***Kuido Gering and Gunnar Wilson.*** *Institute of Metals, Journal*, v. 88, pt. 2; *Institute of Metals, Bulletin*, v. 5, pt. 2, Oct. 1959, p. 49-55.

4602 The Manufacture of Copper Wire for Enamelling. The primary technical requirements in Cu wire for enameling are low annealing temperature and high surface quality. Explains reasons for these requirements and gives details of manufacturing procedures adopted to meet them. The relationship of the empirical characteristic "springiness" to other physical properties of Cu wire is discussed. ***R. D. Carter.*** *Institute of Metals, Journal*, v. 88, pt. 2; *Institute of Metals, Bulletin*, v. 5, pt. 2, Oct. 1959, p. 56-61.

4603 Use of Radioactive Isotopes for Measurement of Cutting Tool Wear. Deals with methods and applications of the isotope technics in determination of wear resistance of cutting tools. Relative measurements were performed by means of a scintillation detector. ***Georg Engstrand.*** *Kungliga Tekniska Högskolans Handlingar*, no. 143, 1959, 17 pp. (T4 K96t Vis.)

4604 Does Compensation of Thermoelectric Currents Influence Cutting Tool Wear? In machining with cemented-carbide tools the oxidation phenomenon is a contributive cause to the wear of the cutting edge. An account is given of the influence of compensating thermocurrents on the wear process. ***Georg Engstrand.*** *Kungliga Tekniska Högskolans Handlingar*, no. 144, 1959, 11 pp. (T4 K96t Vis.)

4605* Rolling of Rings or Tires and the Design of Ring Rolling Mills. History of the development of ring rolling mills. Materials charged and their preparation for rolling. The phenomena occurring in the work-piece during shaping. Design, mode of operation, and possibilities of application of roughing mills. The two-pass rolling mill. The different types of four-high rolling stands for rings of medium and heavy weight. Horizontal single-pass rolling mills of modern design. Rolling mills for heavy and very heavy rings. Vertical single-pass rolling mills. Semi- and fully-automatic types of rolling mills for small and very small rings, particularly those used in the ball-bearing industry. ***Karl-Heinz Weber.*** *Stahl und Eisen*, v. 79, no. 26, Dec. 24, 1959, p. 1912-1923.

4606* Carbide Boring Bar Halves Machining Time. Rigidity of carbide makes it an excellent material for long boring bars. Close tolerances can be held and metal removal rates are higher than with steel bars. ***Leo T. Parker.*** *Tool Engineer*, v. 44, no. 1, Jan. 1960, p. 98-100.

4607 Investigation of Stretch-Forming Process for Fabrication of Reactor Fuel Elements. Three methods of manufacturing fuel rods were investigated: (1) Swaging the fuel tube after loading to attain contact between the UO_2 and the tube. (2) Stretching of the fuel tube to obtain contact between fuel and clad. (3) Segmenting the long fuel column into short sections by stretching the tube until tube contact was achieved with stainless steel discs inserted periodically along the fuel column length. ***M. D'Amore.*** *U. S. Atomic Energy Commission, YAEC-146*, Sept. 1959, 38 pp. (UF767 Un3.1ya Contin.)

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

4608 Time-Temperature-Transformation Diagrams of the Titanium Sheet-Rolling-Program Alloys. A study was made of the transformation kinetics of four commercial Ti alloys for two standard heat-treatment cycles. These alloys were Ti-2,5Al-16V, Ti-4Al-3Mo-1V, Ti-6Al-4V, and Ti-13V-11Cr-3Al. The majority of the data was obtained by metallographic examination and hardness testing. X-ray diffraction, electrical-resistance, and dynamic-elastic-modulus techniques were also utilized where critical information was needed. TTT diagrams were constructed from these results. Each diagram presented in this report is accompanied by a considerable amount of definitive data in the form of photomicrographs and hardness curves. ***L. E. Tanner.*** *Battelle Memorial Institute, Defense*

Metals Information Center, DMIC Report No. 46G, Oct. 19, 1959, 76 pp. (TN799.T5 B32.7t Vis.)

4609* Dispersions of Uranium Carbides in Aluminum for Plate-Type Fuel Elements Requiring High-Uranium Concentrations. Uranium dicarbide appears to be wholly compatible with Al at 600 C. Plate-type fuel elements containing dispersions of UC_2 in Al can be manufactured using established procedures with the exception that the cores must be vacuum degassed prior to rolling into fuel plates. Corrosion testing in 60 C water indicates that UC_2-Al dispersions will corrode catastrophically if the fuel-bearing section is inadvertently exposed to reactor process water. ***W. C. Thurber and R. J. Beaver.*** *Journal of Nuclear Materials,* v. 1, no. 3, Oct. 1959, p. 226-232.

4610* The Plutonium—Uranium System. The Pu-U phase diagram was constructed. All alloys solidify as a body-centered cubic solid solution. Two intermediate phases, both having wide homogeneity ranges, exist in this alloy system, and one of them is stable at elevated temperatures only. ***F. H. Ellinger, R. O. Elliott, and E. M. Cramer.*** *Journal of Nuclear Materials,* v. 1, no. 3, Oct. 1959, p. 233-243.

4611* The Lattice Spacing of Thorium, With Reference to Contamination. Contamination may result from: (1) Filing in air, which results in the solid solution of N. (2) Surface adsorption of gas by exposure to air prior to heat-treatment. (3) Extended heat-treatment at high temperatures. (4) The initial heating of the filings to the annealing temperature. Using the precautions referred to, it is estimated that the error introduced into the lattice spacing by the annealing of Th filings should not exceed 0.0002 *kX.* ***D. S. Evans and G. V. Raynor.*** *Journal of Nuclear Materials,* v. 1, no. 3, Oct. 1959, p. 281-288.

4612* The Alloy System Uranium-Titanium-Zirconium. The U-Ti-Zr system in the composition range to 40 at% Ti, 70 at% Zr is reported in nine isothermal sections between 575 and 1000 C. The principal features of the alloys are discussed. ***B. W. Howlett.*** *Journal of Nuclear Materials,* v. 1, no. 3, Oct. 1959, p. 289-299.

4613 A Study of Electrodiffusion and of Diffusion Combined With Kinetics, by Means of Moment Analysis. Ordinary diffusion of a liquid system may, under certain conditions of experimental work, appear combined with (1) chemical relaxation. In the case of electrolytic components, (2) an electric field superimposed upon the chemical equilibrium system is of interest. The method of moment analysis is introduced as a contribution to the theoretical treatment of (1) and (2). The results of (2) are solutions, in respect to field characteristics. ***Stig Ljunggren.*** *Kungliga Tekniska Högskolans Handlingar,* no. 142, 1959, 23 pp. (T4 K96t Vis.)

4614 Magnetic Properties and the Structure of Metals. General relationships between magnetic and other physical properties of metals. Consideration of newer developments in magnetism which may have application in future. ***W. Sucksmith.*** Paper from "Physics of Non-Destructive Testing", Suppl. No. 6, p. S24-S27, 1957. The Institute of Physics, London. (TA410 In7.6p)

4615* Structure and Hardness Investigation of Oxygen-Free Copper During Recrystallization. Structure and hardness were determined on rolled 0.5 mm-thick oxygen-free Cu sheets with up to 95% deformation, from 2 seconds to 1 hour, after rapid heating up to 200 and 1000 C in salt baths. Tables show time to certain grain sizes at various temperatures and degrees of deformation. *(In German.)* Untersuchung von Gefüge und Härte sauerstofffreien Kupfers während der Rekristallisation. ***H. Borchers and J. Gumper.*** *Metall,* v. 13, Nov. 1959, p. 1010-1016.

4616 Dendritic Growth of Germanium Crystals. By utilizing supercooled melts, the authors believe they have a process for controlled dendritic growth. A theory is presented which explains these growth features and was able to predict the observed anisotropy. ***A. I. Bennett and R. L. Longini.*** *Physical Review,* v. 116, 2nd ser., no. 1, Oct. 1, 1959, p. 53-61.

4617 Tracer Diffusion in a Chemical Concentration Gradient in Silver-Cadmium. Measurements were made on seven Ag-αAgCd diffusion couples of the diffusion of a layer of radioactive tracer atoms (either Ag^{110} or Cd^{109}) located originally at the Ag-AgCd interface. The center of gravity of the layer of tracer atoms shifted from its original position, marked by W wires. The shapes of the tracer profiles for Ag^{110} were quite different from those for Cd^{109}. However, for both Ag and Cd tracer, the center of gravity moved toward the Cd-rich region. ***John R. Manning.*** *Physical Review,* v. 116, 2nd ser., no. 1, Oct. 1, 1959, p. 69-79.

4618 Short-Time Creep of Structural Sheet Metals. The creep behavior of metals at short-time high-temperature conditions cannot be reliably predicted from conventional test equipment and methods. Thirty-seven alloys in 50 different processed or heat-treated conditions were selected for studying especially adapted equipment and procedures. Limited results are given for 19 of the alloys, or particular material was chosen as prototype for detailed discussion. ***John A. VanEcho.*** Paper from "Short-Time High-Temperature Testing", American Society for Metals, Cleveland. 1958, p. 58-91. (TA460 Sy68s)

4619 Structural Changes and Energy Dissipation During Fatigue in Copper. Apparatus and methods used are described, and results summarized; apparently no direct connection between changes in energy dissipation and progress towards fatigue failure; describes other experiments in support of this thesis. ***N. Thompson and N. J. Wadsworth.*** Paper from "Physics of Non-Destructive Testing", Suppl. No. 6, p. S 51- S 55. 1957. The Institute of Physics, London. (TA410 In7.6p)

4620 Some Aspects of the Beta to Alpha Transformation in Uranium: Metallographic Structure and Orientation Relationships. ***H. H. Chiswik and L. T. Lloyd.*** *U. S. Atomic Energy Commission, ANL-*5777, Nov. 1959, 22 pp. (UF767 Un3.1an Contin.)

4621 Solubility Limits of Yttrium and the Lanthanide Rare-Earth Elements in Chromium and Chromium-Iron Alloys. The solubility limits of Y and the lanthanide rare-earth elements in Cr and Cr-Fe alloys were investigated at 2300 F and at room temperature. Bases of pure Cr and Cr alloyed with 10, 25, 50, and 75 w/o Fe were prepared with additions of Ce, Dy, Er, Gd, Ho, La, Lu, Nd, Pr, Sm, Th, Tm, Yb, and Y. Most of the elements investigated are estimated to be soluble to the extent of 0.1 w/o. or less in the base alloys. Dysprosium, Er, and Ho exhibit solubility limits estimated to be between 0.1 and 0.3 w/o. In general, the solubilities of these elements decreased slightly from 2300 F to room temperature. ***S. G. Epstein, A. A. Bauer, and R. F. Dickerson.*** *U. S. Atomic Energy Commission, BMI-*1376, Sept. 1, 1959, 14 pp. (UF767 U3b Contin.)

4622 The Solid Solubility and Constitution of Yttrium in Iron-20 to 40 w/o Chromium Alloys. At 1320 C, the maximum solubility is about 0.12 w/o Y. Study of Fe-rich alloys of the Fe-Y system shows that the compound YFe_5 exists. A eutectic occurs between Fe and YFe_5 at 1257 C. The constitution of Fe-20 to 40 w/o Cr-Y alloys containing less than 6 w/o Y was studied between 1250 and 600 C. ***Martin S. Farkas and Arthur A. Bauer.*** *U. S. Atomic Energy Commission, BMI-*1386, Oct. 20, 1959, 20 pp. (UF767 U3b Contin.)

4623 The Application of Diffusivity Data in Reducing the Hydrogen Content of Gamma-Extruded Uranium Bars. Diffusion coefficients for H in dingot U were determined in the β and γ temperature ranges. For dingot metal in the β region, diffusion coefficients ranged from 4.8×10^{-5} sq cm/sec at 670 C to 6.0×10^{-5} sq cm/sec at 750 C. For the γ region, values ranged from 6.4×10^{-5} sq cm/sec at 800 C to 1.5×10^{-4} sq cm/sec at 970 C. H degassing rates for U cylinders were significantly reduced when oxide and nitride films formed *in situ* at 900 C. ***H. W. Myers, J. W. Varwig, J. L. Marshall, L. G. Weber, and J. A Kennelley*** *U. S. Atomic Energy Commission, MCW-*1439, Dec. 10, 1959, 22 pp. (UF767 Un3.1mc Contin.)

4624 Effect of a Thermal Gradient on the Hydrogen Distribution in a Metal. Application to the Sodium Reactor Experiment. Expressions for the concentration gradient and the over-all concentration necessary for compound formation are derived. The derived equations are applied to the problem of the distribution of H in the Zr cans of the Sodium Reactor

Experiment. If the over-all H concentration exceeds 4 x 10^{-4} atoms of H per atom of Zr, δ-phase Zr hydride will form at the cooler part of the Zr cans. ***G. G. Libowitz.*** *U. S. Atomic Energy Commission, NAA-SR-4194,* Dec. 1, 1959, 16 pp. (UF767 Un3.1na Contin.)

See also: **4556** (formation of flake graphite in cast iron); **4572** (influence of order on resistivity of Au_3Cu).

METALS—POWDER

4625* Phenomena in Metal Powder Preparation by a Simple Electrochemical Technique. Method is shown to be applicable to obtain metal powders from oxides of such metals as Ag, Cu, Zn, Cd, Sb and Sn. It is also applicable for reduction of oxides, hydroxides, and insoluble salts of most of the metals which can be electrolytically deposited. ***P. V. Vasudeva, S. Ghosh, and H. V. K. Udupa.*** *Electroplating,* v. 1, no. 6, Oct. 1959, p. 204-206.

4626 Powder Metallurgy. Describes recent advances and current developments in continuous compacting of metal powders, production of ultra fine powders, particle size determination, bonding carbides to steel, and pressing lubricants. ***J. R. Van Orsdel.*** *Journal of Metals,* v. 12, Jan. 1960, p. 50-51.

4627* The Mechanism of the Compaction of Metal Powders by Rolling. A short historical review of powder rolling is followed by the description of some experiments on the rolling of Cu powder. The factors of greatest importance are the rolling mill (roll diameter, size of roll gap, surface finish of the rolls, rate of powder feed to the rolls and the roll speed), the powder (grain size and particle shape), and the sintering (temperature, time, protective atmosphere). ***P. Evans.*** *Planseeberichte für Pulvermetallurgie,* v. 7, no. 3, Dec. 1959, p. 102-116.

4628* Carbides of Elements of the Fifth Group of the Periodic Table Bonded With Steel. Properties of Va, Ta, and Nb carbides bonded with C steel were determined. Results are compared with the properties of TiC bonded with a similar steel. All compositions responded to heat treatment and were machinable in the annealed condition but each cermet had individual characteristics which are attributed, in part, to differences in the physical and mechanical properties of the various carbides. ***M. Epner and E. Gregory.*** *Planseeberichte für Pulvermetallurgie,* v. 7, no. 3, Dec. 1959, p. 120-128.

4629 Slip Casting Metals. The process of slip casting metal powder is described and compared with ceramic practice. The physico-chemical relationships between powder and vehicle are discussed and the implications of the phenomena observed are related to the technology. ***P. D. S. St. Pierre.*** *Research,* v. 12, Dec. 1959, p. 460-466.

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

4630 The Use of Ultrasonics in the Testing of Irradiated Fuel Elements. The application of ultrasonic techniques in nondestructively locating and identifying unbonded areas between the U core and Al can of Hanford irradiated fuel elements is presented. Details of the underwater equipment and the electronic components are described as well as results of testing. ***John M. Fouts.*** *ASTM Bulletin,* no. 242, Dec. 1959, p. 60-62.

4631* Radiography Checks Welds in Pipe-Type Cable Lines. Photography via γ rays proves to be superior to the pressure method of inspection and testing, speeding up processes of applying Scmastic molds at welds, backfilling trenches and restoring pavement. ***Howard L. Davis, Jr.*** *Electric Light and Power,* v. 38, no. 1, Jan. 1, 1960, p. 52-54.

4632* Fluoroscopic Image Intensifier Devices. Experimental data and information is presented on the characteristics of several image amplifying or intensifying devices. Brightness measurements and response data as a function of X-ray intensity are given. Fluoroscopic technique and sensitivity curves for aluminum and steel are illustrated for each type of amplifying device. Two per cent sensitivity is obtained with special techniques utilizing a 0.3 mm focal spot tube. ***E. L. Criscuolo and C. H. Dyer.*** *Nondestructive Testing,* v. 17, no. 6, Nov.-Dec. 1959, p. 344-349.

4633* A Proposed Instrument for Radiometric Measurements. Acquaints the reader with typical radiometric instrumentation, a proposed method utilizing this equipment, and a possible application. ***L. A. Sarkes, N. L. MacKinnon, R. I. Buckley, and H. J. Boulanger.*** *Nondestructive Testing,* v. 17, no. 6, Nov.-Dec. 1959, p. 351-353.

4634 Physics of Non-Destructive Testing. The contributions published in this supplement are selected from those presented during the past few months at meetings of the Non-Destructive Testing Group of The Institute of Physics. They include most of those read at the Conference held in Bristol in July, 1956, and are printed here in the order in which they were presented. Suppl. No. 6. 72 pp. 1957. The Institute of Physics, London. (TA410 In7.6p)

4635* Quality Control System Governs Each Step in Production of Welded Steel Tubing. Developed to meet the needs of the petrochemical industry, new electric resistance welded carbon steel tubing is uniform, easy to work, strong, and less costly than seamless tubing. *Welding Design & Fabrication,* v. 32, Nov. 1959, p. 70 + 3 pages.

4636* Ultrasonic Weld Inspection at Work in Industry Has Resulted in the Development of Efficient and Reliable Quality-Control Techniques. A great amount of work has been done in the past utilizing ultrasonic testing for the evaluation of welds. It is notable that a large portion of the successful application of this technique has been accomplished by a relatively small number of individuals and companies. ***John E. Bobbin.*** *Welding Journal,* v. 39, Jan. 1960, p. 34-38.

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

4637 Design Studies of Capsules for High-Temperature Irradiations. Since the irradiation damage suffered by fuel specimens is sensitive to small changes in temperature and burnup, improvements in precision in irradiation testing are of great importance in fuel studies. For this reason, a preliminary engineering analysis was made of the problems of control and measurements of specimen temperature and heat generation in a NaK-filled capsule containing a fuel specimen. A specific problem is used in this report to demonstrate the large uncertainties normally encountered even in capsules containing thermocouples. This analysis indicates that an improvement by a factor of more than 3 may be obtained by use of a differential-thermocouple heat-flow meter and by use of precision thermocouple placement clips. ***John H. Stang, William H. Goldthwaite, and Bruce W. Dunnington.*** *ASTM Bulletin,* no. 242, Dec. 1959, p. 54-59.

4638* First Forbidden Beta Transitions for the Universal Fermi Interaction. Presents formulae for the electron polarization in recoil experiments for the case of first forbidden β transitions. The formulae were derived by means of the Cutkosky-Deloff trace technique. All Coulomb effects are included. In accordance with the present knowledge of β-decay the vector and axial vector parts of the universal Fermi interaction are retained, with different coupling constants. ***Bronisław Kuchowicz.*** *Acta Physica Polonica,* v. 18, no. 4, 1959, p. 347-360.

4639* Nuclear Effects on Materials. Brief review of gamma ray and fast neutron irradiation effects. *Aircraft and Missiles,* v. 2, Dec. 1959, p. 22-24.

4640* Why Nuclear Rockets? Discusses inevitability of nuclear rockets and lists major projects in this area and the design problems involved. ***S. Peter Kaprielyan.*** *Aircraft and Missiles,* v. 2, Dec. 1959, p. 30-32.

4641* Analogue Studies of the Control Response and Temperature Coefficient of Uranium-Water Reactors Operating With Intermediate-Energy Neutrons. Discusses the investigation results of analogue studies of control response and of temperature effect, caused by change of the density of water of U-H_2O reactors operating with intermediate energy neutrons. The effectiveness of different type of control rods was determined; the relation between critical dimensions of U-H_2O reactors and the density of water, filling the active zone, was obtained. (*In Russian.*) Modelirovanie protsessa regulirovaniya i temperaturnogo izmeneniya plotnosti vody v uranvodyarykh reaktorakh na promezhutochnykh neĭtronakh. ***V. B. Klimentov and V. M. Gryazev.*** *Atomnaia Energiia,* v. 7, no. 6, Dec. 1959, p. 519-523.

4642* The Burn-Up of Natural Uranium in a Homogeneous Reactor. One of the significant advantages of homogeneous reactors compared with heterogeneous ones is the lack of the problem of the stability of heat-liberating elements. Therefore the degree of safe burn-up of U and consequently also the economical indexes of the homogeneous reactor can be considerably raised. Cites the amount of burn-up of the U dependent on the initial parameters of the system; there is also determined the condition for the evidence of engagement of the neutron in U^{238} at retardation, on which a maximum burn-up in the reactor is reached, with a restoration of U. *(In Russian.)* Vygoranie prirodnogo urana v gomogennom reaktore. ***Va'clav Bartosek.*** *Atomnaia Energiia,* v. 7, no. 6, Dec. 1959, p. 524-530.

4643* Solubility of Uranium and Other Metals in Lithium. The solubility of U, Zr, Fe, Ni, Ti, Mo, Nb, and Be in Li at temperatures of 700-1000 C was determined for the rating of the stability of metals in Li and for the examination of the mechanism of corrosion. It was found that Ni and Be are of a high solubility (of the order of 0.1%), Fe, Zr, Ti, and U are of a low solubility (from hundreds to thousands parts of a per cent), but Nb and Mo are of a very low solubility (less than 10-4%). (*In Russian.*) Opredelenie rastvorimosti metallov v litii. ***Yu. F. Bychkov, A. N. Rozanov, and V. B. Yakovleva.*** *Atomnaia Energiia,* v. 7, no. 6, Dec. 1959, p. 531-536.

4644* Influence of Temperature on Reactor Dynamics. The reactor temperature influences the chain reaction mainly through density changes consequent upon thermal expansion and through changes in the relative velocities of neutrons and atomic nuclei. This becomes evident in the differing course of the temperature dependence of the fission and capture cross-sections of the various reactor and fuel materials. *(In German.)* Einfluss der Temperatur auf die Reaktordynamik. ***G. Kourim.*** *Atomwirtschaft,* v. 4, no. 12, Dec. 1959, p. 533-536.

4645 Measurement of the Spontaneous Fission Neutron Yield of Natural Uranium. A measurement of the spontaneous fission neutron yield of natural U has been made by the activation of approximately 1500 l. of $KMnO_4$ solution in a sub-critical assembly containing over 5000 lb of natural U. By filtering a large volume of this solution, sufficient Mn activity is removed as MnO_2 by the Szilard-Chalmers effect to provide an accuracy of 1·5% in the result. However, since the total efficiency of the MnO_2 extraction process was not known to this high degree of accuracy, comparison of the activation by Pu-Be sources of known strength superimposed over the U was made. ***A. W. Waltner and B. E. Leonard.*** *Journal of Nuclear Energy,* v. 11, no. 1, pt. A, Nov. 1959, p. 1-7.

4646* Design Study of a 300-MW Organic-Cooled Reactor. ***R. Balent, G. H. Bosworth, and J. Plawchan.*** *Mechanical Engineering,* v. 81, Dec. 1959, p. 72-77.

4647* Energy Production From Nuclear Reactions. Reviews some basic facts of nuclei and nuclear reactions, leading to the conclusion that energy from nuclear reactions is best sought in the fusion of light elements and in the fission of heavy elements. Presents some of the requirements and difficulties of controlled fusion reactions, and discusses some of the energy consequences of the controlled release of fission energy. ***Harry Soodak.*** *New York Academy of Sciences, Transactions,* v. 22, no. 1, Nov. 1959, p. 26-33.

4648* A Longitudinal β-Spectrometer With Compensated Spherical Aberration. ***K. A. Dolmatova and V. M. Kelman.*** *Nuclear Instruments and Methods,* v. 5, Nov. 1959, p. 269-279.

4649* Engineering Methods for Electron-Beam Processing. The shielding for a processing installation can be minimized by the use of a shallow pit with local shielding around the point of beam use. Magnetic systems can be used to change beam geometry external to the accelerator. A beam inverter has been developed so that a product can be bombarded from both sides simultaneously with one accelerator. An intermittent filter was also tested. The efficiency of double bombardment is thereby increased to about 80%, because the uniformity of dose is greatly improved. The availability of new metal alloys in the form of thin sheets and thin-walled tubes makes possible the development of new techniques for irradiating fluids under elevated pressure and temperature in continuous flow. This will permit pressures up to about 40 atmospheres, with a 90% beam-use efficiency. Tubular reactors permit pressures of 75 atmospheres with a 50% efficiency. ***D. A. Trageser.*** *Nuclear Instruments and Methods,* v. 6, Dec. 1959, p. 26-32.

4650* The Proportional Counter as a Charged Particle Spectrometer. A proportional counter is described which is suitable as broad range charged particle spectrometer for the investigation of nuclear reaction products. Its performance has been investigated experimentally and an energy resolution of 1.6% has been obtained with protons of 8 MeV. ***S. Abid Husain and A. A. Jaffe.*** *Nuclear Instruments and Methods,* v. 6, Dec. 1959, p. 50-56.

4651* Gamma Ray Spectra and Parameters of Neutron Resonances in Mercury. The gamma ray spectra from resonant neutron capture in mercury suggest that resonances in Hg^{199} at 33.5, 175, 263 and 315 eV have $J = 1$, while the 128 eV resonance has $J = 0$. These results are in agreement with the results of transmission measurements. Resonance parameters are determined for seven resonances up to 209 eV. The presence of gamma ray peaks at either 368 or 439 keV assists in the allocation of resonances to either Hg^{199} or Hg^{201}. ***J. R. Bird, M. C. Moxon, and F. W. K. Firk.*** *Nuclear Physics,* v. 13, no. 4, Nov. 1959, p. 525-540.

4652* Central and Peripheral Collisions Between Fast Nucleons (I). About 83% of all inelastic collisions occurring at energies of 9 GeV in the examined model are collisions involving the central regions of the nucleons. For calculation of these "central collisions", methods of the statistical theory of multiple production of particles can be employed. With the exception of small angles and events in which a small number of particles participate, the data thus obtained are in good agreement with the experiments. ***V. S. Barashenkov, V. M. Maltsev, and E. K. Mihul.*** *Nuclear Physics,* v. 13, no. 4, Nov. 1959, p. 583-593.

4653* The Medium and High Energy Optical Model and the Correlations in the Nuclear Wave Function. Watson's multiple scattering theory is applied to calculate the well depths of the nuclear optical potential for the case of strongly correlated nuclear matter. The nuclear ground state is represented by a Jastrow type wave function. The consequences of the Bethe-Goldstone equation for the correlation functions are considered. ***J. Dabrowski and J. Sawicki.*** *Nuclear Physics,* v. 13, no. 5, Nov. 1959, p. 621-641.

4654* Superfluidity and the Moments of Inertia of Nuclei. Moments of inertia are computed by the applied method in the quasi-classical approximation and satisfactory agreement with the observed values is obtained. The calculated increase of the moment of inertia upon transition from even- to odd-mass nuclei and also the gyromagnetic ratio for rotating nuclei are in agreement with the experiments. These results confirm the assumption of superfluidity of nuclear matter. ***A. B. Migdal.*** *Nuclear Physics,* v. 13, no. 5, Nov. 1959, p. 655-674.

4655* E2 Transitions From the Second 2+ Level of Even-Even Nuclei. From available data three ratios of reduced E2 transition probabilities have been calculated, and compared

with the predictions of various theories. The comparisons indicate that by far the most successful theory to date for predicting such ratios is the recent asymmetric rotor model of Davydov and Filippov. ***D. M. Van Patter.*** *Nuclear Physics*, v. 14, no. 1, Dec. 1959, p. 42-59.

4656* Inelastic Neutron Scattering in Nb^{93}. Study of gamma-ray spectra following inelastic neutron scattering in Nb^{93} was made at bombarding energies ranging from 0.81 to 2.25 MeV. In all, fourteen gamma-ray transitions were detected and the possibility of a few more is indicated. ***N. Nath, M. A. Rothman, D. M. Van Patter, and C. E. Mandeville.*** *Nuclear Physics*, v. 14, no. 1, Dec. 1959, p. 78-96.

4657* High Pressure Water Loop in Dido. The first of its kind in the UK, this recently commissioned facility at Harwell will be used for PWR research, particularly on marine reactors. Tests under operational conditions of pressure, temperature and radiation will cover heat transfer, burnup, corrosion of structural materials and coolant chemistry. ***I. Everson.*** *Nuclear Power*, v. 4, Dec. 1959, p. 103-108.

4658* Gamma Compensated Ionization Chambers for Reactor Control. A d.c. ionization chamber capable of operating at low flux levels is now commercially available and will be particularly useful in research reactors. ***A. L. Gray.*** *Nuclear Power*, v. 4, Dec. 1959, p. 112-116.

4659* Nuclear Safety. A review of recent developments. *Nuclear Safety*, v. 1, no. 2, Dec. 1959, 66 pp.

4660* Reactivity Associated With the Decay of Np^{239} in Irradiated Natural Uranium Dioxide. In the calculation of irradiation-induced changes in reactivity in natural uranium, the direct formation of Pu^{239} upon neutron capture in U^{238} is frequently assumed. The attendant error in reactivity during irradiation is shown to be significant for an illustrative case even after high exposure. This suggests that the consequences should be examined when the direct formation of Pu^{239} is assumed. ***S. B. Gunst.*** *Nuclear Science and Engineering*, v. 6, Nov. 1959, p. 376-378.

4661* The Temperature Dependence of the Fission Cross Sections of Pu^{239}, U^{235}, and U^{233}. The dependence on neutron temperature of the ratio of thermal neutron fission cross sections, σ f (Pu^{239})/σ f (U^{235}) and σ f (Pu^{239})/σ f (U^{233}), has been measured in heavy water moderator. Satisfactory agreement was obtained with the temperature dependence of the cross sections for Maxwellian neutron spectra calculated by C. H. Westcott from the neutron cross section energy dependence. Measurements have also been made of the spatial distribution of neutron temperature in a tank of heavy water. ***C. B. Bigham.*** *Nuclear Science and Engineering*, v. 6, Nov. 1959, p. 379-385.

4662* Simplified Simulation of a Boiling Water Reactor Power Plant. Using analog computer facilities available at most universities, a boiling water reactor power plant was simulated in order to study for instructional purposes the system response to various deviations from normal operation conditions. The rather idealized model, which was similar to EBWR, was found to be quite stable and to behave qualitatively in a manner expected from boiling reactor experience. ***Robley E. George and Alexander Sesonske.*** *Nuclear Science and Engineering*, v. 6, Nov. 1959, p. 409-413.

4663* New Ideas for Nuclear Reactors. Estimates of world energy resources are summarized. It is pointed out that the great effort to exploit nuclear energy can be justified only if it is directed toward a full utilization of uranium and thorium. Recent findings on nuclear reactor stability are discussed and the value of computing machines in theoretical studies is noted. A commentary on current concepts in reactors is presented. Direct conversion of nuclear heat into electricity is briefly reviewed. ***Eugene P. Wigner.*** *Nuclear Science and Engineering*, v. 6, Nov. 1959, p. 420-432.

4664* Neutron Spectra Measurements. Thermal neutron spectra have been measured with time-of-flight techniques. Spectra were obtained for pure water and for a nearly homogeneous subcritical assembly where the ratio of thermal absorption to high-energy scattering cross section was ~0.3. For each medium, spectra were measured at 298 and 586 K. The agreement between theory and experiment is excellent. On the basis of this agreement, one concludes that chemical binding effects in light water play a negligible role in determining the equilibrium neutron spectrum in water assemblies. ***R. S. Stone and R. E. Slovacek.*** *Nuclear Science and Engineering*, v. 6, Dec. 1959, p. 466-474.

4665* Breeding Potential of Thermal Reactors. The breeding potential of thermal reactors is re-evaluated on the basis of present nuclear data. It is concluded that positive breeding on the U^{233}, Th cycle is possible with a variety of moderators including heavy water, graphite, beryllium, and ordinary water. Current measurements indicate that the accepted thermal value of $\eta 23 = 2.28 \pm 0.02$ is somewhat conservative. ***J. Chernick and S. Oleksa Moore.*** *Nuclear Science and Engineering*, v. 6, Dec. 1959, p. 537-544.

4666 Building Dresden. Dresden construction experience has shown that the job of assembling a full-scale nuclear power station, although not yet routine, can be kept on a schedule as firm as those for conventional plants. *Nucleonics*, v. 17, Dec. 1959, p. 65-75.

4667 Turret—A Test of Unclad Fuel. Los Alamos Scientific Laboratory, at the request of the AEC, is planning a 3-Mw (th) test of a helium-cooled reactor system using unclad fuel exposed directly to the working fluid; we hope by operating this reactor, which we call TURRET, to allow full display of the expected advantages and problems of "contaminated-loop" reactors. ***R. P. Hammond, et al.*** *Nucleonics*, v. 17, Dec. 1959, p. 106-109.

4668 The Analysis of 4·5 BeV Negative Pion Interactions in Nuclear Emulsion. Two hundred nuclear interactions produced in Ilford G5 nuclear emulsion by 4·5 BeV $\pi-$ mesons have been analyzed. The transverse momentum of those secondary shower particles identified as pions has an average value over all angles of 290 ± 50 MeV/c. About 90% of the shower particles were estimated to be pions. The angular distribution in the C-system is anisotropic with a mean value for $|\cos \theta^*|$ of 0·58 ± 0·03. Assuming that secondary pions are emitted symmetrically backwards and forwards from a single collision system, the observed angular distribution of shower particles has been used to determine the effective mass of the collision partner. ***H. H. Aly, J. G. M. Duthie, and C. M. Fisher.*** *Philosophical Magazine*, v. 4, ser. 8, Sept. 1959, p. 993-1005.

4669 The Multiple Scattering of Particles of Opposite Charge. Earlier investigations have revealed an apparent difference in the multiple scattering of positively and negatively charged particles which is much greater than that predicted by theory. Experiments have been carried out in which the existence of such a difference was investigated for the multiple scattering of positive and negative μ mesons, π mesons and electrons in nuclear emulsions. No significant difference was found. ***I. S. Hughes and D. Sinclair.*** *Philosophical Magazine*, v. 4, ser. 8, Sept, 1959, p. 1013-1016.

4670 The Interaction Rates of Stopped Negative Muons in Various Elements. The lifetimes of negative muons brought to rest in a series of elements have been measured. Using different assumptions, the various interaction rates have been calculated and compared with the theories of Primakoff, Tolhoek, and Luyten. Measurements of the time delays in Geiger counter discharges and photomultiplier after-pulses are described. ***W. B. Gilboy and R. M. Tennent.*** *Philosophical Magazine*, v. 4, ser. 8, Sept. 1959, p. 1055-1062.

4671 Radiative Capture of Protons by Be. The γ rays from the capture in Be^9 of protons of energy between 0.27 and 1.2 Mev have been studied using large scintillation crystals. Excitation functions of the γ rays leading to the 0-, 0.72-, 1.74-, 2.15-, 3.58-, and 5.16-Mev states of B^{10} were computed from the measured γ-ray spectra. ***W. E. Meyerhof, N. W. Tanner, and C. M. Hudson.*** *Physical Review*, v. 115, 2nd ser., no. 5, Sept. 1, 1959, p. 1227-1237.

4672 Radiochemical Studies of the Fission of U^{235} Induced by Helium Ions. The absolute fission yields of approximately 25 nuclides from the He-ion-induced fission of U^{235} were determined with an accuracy of ± 5-15% for several energies ranging from 20 to 40 Mev. ***R. Gunnink and J. W.***

Cobble. *Physical Review*, v. 115, 2nd ser., no. 5, Sept. 1, 1959, p. 1247-1256.

4673 Simple Model for Giant Resonance Effects in Nuclear Reactions. A simple model for the scattering of *s*-wave neutrons is discussed. The scattering interaction is a square-well potential modified by allowing transmission through the origin to a mode of motion characterized by many narrow resonances. When the coupling out of the incident channel is weak, the cross section is found to have a resonant part which shows the giant resonance behavior observed in nuclear scattering. ***W. Tobocman and D. E. Bilhorn.*** *Physical Review*, v. 115, 2nd ser., no. 5, Sept. 1, 1959, p. 1275-1277.

4674 N^{14}-N^{15} Hyperfine Anomaly. The optical transmission of an optically oriented sodium vapor in spin-exchange equilibrium with atomic nitrogen has been used to measure the zero-field hyperfine splitting of N^{14} and N^{15}. The nuclear moments of N^{14} and N^{15} have been remeasured by observing the effect of saturating the nitrogen resonance on the proton resonance in NH_4^+. A short discussion of the mechanism of spin-exchange collisions is given. ***L. Wilmer Anderson and Francis M. Pipkin.*** *Physical Review*, v. 116, 2nd ser., no. 1, Oct. 1, 1959, p. 87-98.

4675 Energy Dependence of Fission Fragment Anisotropy. The dependence is discussed in terms of the Bohr model. It is shown that reasonable assumptions about the spectrum of excited states at the barrier lead to results consistent with the currently available data for energies up to 10 Mev and for a variety of target nuclides, except for the fact that the target spin appears to have a much smaller effect on the anisotropy than might have been predicted. ***James J. Griffin.*** *Physical Review*, v. 116, 2nd ser., no. 1, Oct. 1, 1959, p. 107-118.

4676 Gamma Rays From the Nuclear Photoeffect in Carbon, Oxygen, and Copper. A NaI crystal was used to study the spectra of gamma rays associated with the giant resonance cross section of the nuclear photoeffect in carbon, oxygen, and copper. The X-ray source was a bremsstrahlung beam whose energy was varied from 19 to 61 Mev. Cross sections for elastic, and mixed elastic and inelastic scattering were measured at 135° to the X-ray beam. The elastic scattering cross section for carbon can be predicted in a similar fashion, but the oxygen cross section cannot. The angular dependence of the oxygen elastic scattering cross section near 22 Mev is predominantly dipole with a possible quadrupole admixture. For oxygen, an inelastic scattering cross section was observed which has a threshold at about 26 Mev, a peak at about 30 Mev, and is due to transitions to a state (or states) near 6 Mev. The consequences of this interpretation to the theory of the nuclear photoeffect is discussed. The yield of gamma rays from O^{18} and N^{18} which follow neutron or proton emission was also studied and several lines were observed, but none above 6.5 Mev. ***A. S. Penfold and E. L. Garwin.*** *Physical Review*, v. 116, 2nd ser., no. 1, Oct. 1, 1959, p. 120-130.

4677 Decay of U^{240} and 7.3-min Np^{240}. The radiations of U^{240} and 7.3-min Np^{240} have been studied with a solenoidal beta spectrometer, beta- and gamma-scintillation spectrometers, and 180° permanent-magnet spectrographs. The principal decay branch of U^{240} is a 0.36-Mev beta transition to the 7.3-min state of Np^{240}. The only other radiations observed which are attributed to U^{240} are the conversion lines associated with a 0.044-Mev transition. ***M. E. Bunker, et al.*** *Physical Review*, v. 116, 2nd ser., no. 1, Oct. 1, 1959, p. 143-153.

4678 Nucleon Correlation Effects in High-Energy Electron Scattering. By using Schiff's high-energy approximation, a sum role is developed which relates the scattering of high-energy electrons from heavy nuclei to the two-particle correlation function for the nucleus. It is shown that correlations due to the Pauli principle give a large effect in the region of momentum transfer from 100 to 300 Mev/c, and that correlations with a range of less than 10^{-13} cm do not make appreciable contribution. ***W. E. Drummond.*** *Physical Review*, v. 116, 2nd ser., no. 1, Oct. 1, 1959, p. 183-193.

4679 Surface Coupling Mechanism for Approaching Statistical Equilibrium in Compound Nucleus Formation, With Application to Fission. In a particular representation where the state vectors are not eigenstates of the Hamiltonian, coupling terms remain which cause "virtual" or "real" transitions among states. An appropriate choice of representation depends upon the physical processes involved. The decay of a compound nucleus, especially by fission, is considered. The strong coupling representation of the unified model is employed, with surfaces oscillations inducing transitions among states of the representation. ***Lawrence Wilets.*** *Physical Review*, v. 116, 2nd ser., no. 2, Oct. 15, 1959, p. 372-382.

4680 Spallation-Fission Competition in Heavy-Element Reactions: Th^{232} + He^4 and U^{233} + *d*. Cross sections and excitation functions were determined for spallation and fission products from bombardments of Th^{232} with He ions (15 to 46 Mev) and U^{233} with deuterons (9 to 24 Mev). The results show that fission is the predominant reaction at all energies for Th^{232} and to an even greater extent for U^{233}. ***Bruce M. Foreman, Jr., Walter M. Gibson, Richard A. Glass, and Glenn T. Seaborg.*** *Physical Review*, v. 116, 2nd ser., no. 2, Oct. 15, 1959, p. 382-392.

4681 Cosmic-Ray Neutron Energy Spectrum. The cosmic-ray neutron energy spectrum in the equilibrium region of the atmosphere was measured with several different calibrated detectors from thermal energies to about 1 Bev at 44° north magnetic latitude and up to 40,000 feet. By combination of the data from these measurements with those from other experiments, a complete differential energy spectrum is obtained which shows the characteristic maximum near thermal energies and a roughly $1/E$ variation up to about 100 kev. ***Wilmot N. Hess, H. Wade Patterson, and Roger Wallace.*** *Physical Review*, v. 116, 2nd ser., no. 2, Oct. 15, 1959, p. 445-457.

4682 Magnetic Moment of the Proton in Units of the Bohr Magneton; the Magnetic Moment of the Electron. Gives details of a previously reported measurement of the proton magnetic moment in units of the Bohr magneton. This ratio of moments, which is obtained from common magnetic field observations of the nuclear magnetic resonance frequency of protons in a spherical sample of mineral oil and the cyclotron frequency of free low-energy electrons, is found to be $\mu p(\text{oil})/\mu O = (657.462 \pm 0.003)^{-1}$, where the uncertainty represents the estimated 50% probable error. The magnetic moment of the free proton is found, upon application of the appropriate diamagnetic correction factor, to be $\mu p/\mu O = (657.442 \pm 0.003)^{-1}$. ***Sidney Liebes, Jr., and Peter Franken.*** *Physical Review*, v. 116, 2nd ser., no. 3, Nov. 1, 1959, p. 633-650.

4683 Monte Carlo Calculations of Nuclear Evaporation Processes. III. Applications to Low-Energy Reactions. Monte Carlo calculations of nuclear reactions in the low-energy ($E < 50$ Mev) region are described. The calculations are based on the nuclear evaporation model of Weisskopf. Continuum theory was used for the calculation of inverse reaction cross sections. Computed excitation functions are shown for all the reactions studied as well as for several reactions for which experimental data are not yet available. Further experiments on reaction cross sections are suggested which would allow a unique determination of the pairing and shell energy corrections of level densities for any value of Z and N in the region under discussion. The existence of a unique set of these correction terms would provide strong evidence for the validity of evaporation theory for the reactions considered. ***I. Dostrovsky, Z. Fraenkel, and G. Friedlander.*** *Physical Review*, v. 116, 2nd ser., no. 3, Nov. 1, 1959, p. 683-702.

4684 Cross Section for Compound-Nucleus Formation in Heavy-Ion-Induced Reactions. Compound-nucleus-formation cross sections for various systems of heavy ions and targets have been calculated by using two simple models. The first model, based on a square-well nuclear potential, gives reasonable agreement with experiment if a radius parameter $r = 1.5 \times 10^{-13}$ is used. The second model, based on a diffuse nuclear potential gives agreement if $r = 1.17 \times 10^{-13}$ cm is used. The cross sections calculated by using the first model are presented for various energies of the systems C, N, O, and Ne incident on Al, K, Cu, Ag, Pr, Au, and U. Also tabulated are the average values of the orbital angular momentum for each system at each energy. ***T. Darrah Thomas.*** *Physical Review*, v. 116, 2nd ser., no. 3, Nov. 1, 1959, p. 703-712.

4685* Search for the "Anomalous" Scattering of Mu-Mesons (On the Apparatus Using a Delayed Coincidence Method). As a result of the discussion about the experimental results on the anomalous scattering of mu-mesons so far obtained, we came to the conclusion that their apparatuses have two principal deficiencies in reaching a definite information: uncertainties in determining the identity and momenta of mu-mesons. Hence, we have a plan to complete the experiment by using an arrangement of Wilson cloud chamber and G. M. counters which is capable of selecting only mu-mesons. ***Takashi Kitamura.*** *Physical Society of Japan, Journal,* v. 14, Dec. 1959, p. 1654-1663.

4686 Interpretation of Isotope Shifts in the Rare Gases. A successful qualitative interpretation of observed isotope shifts in Ne, A, Kr, Xe is obtained by considering the specific mass effect in intermediate coupling. ***A. P. Stone.*** *Physical Society, Proceedings,* v. 74, pt. 4, Oct. 1, 1959, p. 424-431.

4687* A Note on the Dispersion-Theoretic Approach to the One Additional Pion Production by Pion-Nucleon Collision. A "natural" frame of reference to derive the dispersion relation for the one additional pion production by pion-nucleon collision is introduced. It is a natural extension of what is introduced in the elastic pion-nucleon scattering. We then derive the dispersion relation connecting the dispersive parts and the absorptive parts. We shall use this relation in future as the integral equation for the scattering matrix element. Finally, the absorptive parts are investigated. ***Kin-ichi Ishida.*** *Progress of Theoretical Physics,* v. 22, no. 4, Oct. 1959, p. 499-512.

4688* Note on the Spin-Orbit Coupling and Tensor Forces. The spin-orbit coupling in heavy nuclei is investigated on the basis of strong tensor interaction between nucleons, characteristic of the pion theory of nuclear force. It is shown that the process which includes the exchange of the incident nucleon with those of the target nucleus deformed by itself is important in the low energy region, and that this process provides the spin-orbit coupling with a correct sign and reasonable magnitude. ***Shuji Takagi, Wataro Watari, and Masaru Yasuno.*** *Progress of Theoretical Physics,* v. 22, no. 4, Oct. 1959, p. 549-565.

4689* Two-Nucleon Potential With the "One-Pion-Exchange Tail". It is shown that p-p single and double scattering up to 150 Mev can be reproduced by a potential with the "one-pion-exchange tail" in its outer part, without assuming any seriously energy-dependent interactions and spin-orbit coupling potentials. The intermediate part of the potential has all features that are characteristic of the two-pion-exchange potential. Qualitative reasoning of this potential is given together with the results of calculation. ***Tetsuo Hamada, Junji Iwadare, Shoichiro Otsuki, Ryozo Tamagaki, and Wataro Watari.*** *Progress of Theoretical Physics,* v. 22, no. 4, Oct. 1959, p. 566-584.

4690 Linearly Biased Track Counting in Cross-Section Determinations. In determining the average number n of tracks per bubble chamber picture, for purposes of determining cross sections, one usually cannot count all tracks, but counts tracks in only some of the pictures, selected at random. An alternative procedure is described here in which the pictures are not selected at random, but are those which contain the "interesting events". The average of $1/n$ over this "linearly biased" sample equals $1/n$, where n is the desired average over a random sample. ***Frank S. Crawford, Jr.*** *Review of Scientific Instruments,* v. 30, Dec. 1959, p. 1096-1097.

4691 Simplified Logarithmic Radiation Meter Using Noise. A logarithmic radiation meter was developed which uses an ac-coupled logarithmic voltmeter to measure the random noise from a photomultiplier detector. A range of four decades was obtained. ***Charles Erwin Cohn.*** *Review of Scientific Instruments,* v. 30, Dec. 1959, p. 1097-1099.

4692 Semi-Homogeneous High-Temperature Gas-Cooled Breeder Reactors. ***K. Inoue, T. Kuroyanagi, and S. Yajima.*** *U. S. Atomic Energy Commission, AEC-tr-*3620, Oct. 28, 1958, 86 pp. (UF767 Un3.1ae Contin.)

4693 Fuel Defect Test—Borax-IV. On March 11 and 12, 1958, the BORAX-IV reactor was operated at a power of 2.4 Mw, even though a large number of the fuel elements contained defects through the cladding. Subsequent investigation showed that 22 of the fuel elements in the reactor contained one or more ruptured rods. The effluent gases, the reactor steam, the condensate, and the reactor water were sampled during steady operation and analyzed for fission product gases and other fission products. ***R. F. S. Robertson and V. C. Hall, Jr.*** *U. S. Atomic Energy Commission, ANL-*5862, Oct. 1959, 46 pp. (UF767 Un3.1an Contin.)

4694 Modification of CP-5 Fuel Assemblies for Fuel Capsule Irradiation Experiments. The standard vertical fuel tube assembly of the CP-5 research reactor was modified to permit diversion of heavy water coolant into the thimble for temperature-controlled irradiation experiments of capsules containing fuel specimens. The modification entailed revisions to the thimble, outer top shield plug and center shield plug, and He sweep system. The modified thimble is provided with inlet and outlet ports which circulate heavy water from the reactor flow system through the thimble cavity. ***W. N. Beck, J. H. Kittel, and F. L. Brown.*** *U. S. Atomic Energy Commission, ANL-*6041, Nov. 1959, 24 pp. (UF767 Un3.1an Contin.)

4695 Analytic Solution of the Steady-State Wave Equation in Three Dimensions and in Irregularly Shaped Domains With an Application to a Reactor With Partially Inserted Control Rods. Statement and restatement of the problem, consideration of the steady-state wave equation and statement of theorem I, proof of theorem I by a method of successive approximations, perturbation formulas for the eigenvalues and eigenfunctions, determination of the flux and buckling for a homogeneous reactor and other problems are discussed. ***E. J. Betinis.*** *U. S. Atomic Energy Commission, ANL-*6051, Sept. 1959, 100 pp. (UF767 Un3.1an Contin.)

4696 Lecture Notes on Heat Extraction From Boiling Water Power Reactors. ***P. A. Lottes, M. Petrick, and J. F. Marchaterre.*** *U. S. Atomic Energy Commission, ANL-*6063, Oct. 1959, 171 pp. (UF767 Un3.1an Contin.)

4697 Isotopic Abundance and the Variation of η in Irradiated Nuclear Fuels Consisting Initially of Combinations of Th^{232}, U^{238}, and U^{235}. The abundances of the significant isotopes and the variation of η during the irradiation of a nuclear fuel, which initially consists of combinations of U^{235}, U^{238}, and Th^{232}, is presented. ***J. C. Carter and R. C. Howard.*** *U. S. Atomic Energy Commission, ANL-*6067, Oct. 1959, 71 pp. (UF767 Un3.1an Contin.)

4698 Progress Relating to Civilian Applications During September, 1959. Includes BMI reports on "Development of Uranium Nitride-Stainless Steel Dispersion Fuel Elements", "Spray Deposition of Calcium Metal on Nickel or Inconel", "Progress on the Use of Gas-Pressure Bonding for Fabricating Low-Cost Ceramic, Cermet, and Dispersion Fuels", and "The Diffusion of Hydrogen in Beta Zirconium". ***Russell W. Dayton and Clyde R. Tipton, Jr.*** *U. S. Atomic Energy Commission, BMI-*1381, Oct. 1, 1959, 103 pp. (UF767 U3b Contin.)

4699 ML-1-1A Core Studies With the GCRE Critical Assembly. Critical-assembly studies were conducted to provide physics and engineering data to aid in developing the Mobile Low-Power Reactor (ML-1). Two 1A production fuel elements were evaluated in the critical-assembly core. The results predict that the production elements tested contained roughly the same fuel as the critical-assembly element and an additional 772 g of stainless steel equivalent on the average. Radial power and neutron-flux distributions were measured in a 19-pin 1B fuel element. Fairly uniform distributions were observed. Data to evaluate the thermal utilization of this element were obtained. ***Richard A. Egen, William S. Hogan, David A. Dingee, and Joel W. Chastain.*** *U. S. Atomic Energy Commission, BMI-*1396, Nov. 27, 1959, 33 pp. (UF767 U3b Contin.)

4700 Heavy Water Moderated Power Reactors. Continued progress is reported on the design and construction of the Heavy Water Components Test Reactor (HWCTR), a high temperature facility for simultaneously irradiating sizable numbers of fuel elements. ***D. F. Babcock.*** *U. S. Atomic Energy Commission, DP-*405, Oct. 1959, 42 pp. (UF767 Un3.1dp Contin.)

4701 Heavy Water Moderated Power Reactors. Progress Report, August 1959. Continued progress is reported on the design and construction of the Heavy Water Components Test Reactor; 70% of the firm design and 10% of the construction were complete at the end of August 1959. Further study was made of the behavior of the HWCTR following unusual incidents, malfunctions, and accidents. The results of additional irradiation tests of U metal fuel tubes and of Zircaloy and Zr components also are reported. ***D. F. Babcock.*** *U. S. Atomic Energy Commission, DP-415,* Oct. 1959, 59 pp. (UF767 Un3.1dp Contin.)

4702 Heavy Water Moderated Power Reactors. The results to date of the du Pont study of natural-U-fueled, heavy-water-moderated power reactors are reviewed. The scope of the program and its current goals are presented. Continued progress is reported on the design and construction of the Heavy Water Components Test Reactor. The results of additional fabrication tests on proto-type fuel elements of natural U metal and of natural uranium oxide are also recorded. ***D. F. Babcock.*** *U. S. Atomic Energy Commission, DP-425,* Nov. 1959, 33 pp. (UF767 Un3.1dp Contin.)

4703 Plutonium Recycle Test Reactor. Final Safeguards Analysis. The Plutonium Recycle Test Reactor (PRTR) is designed to obtain experimental data on Pu fuel technology and Pu fuel cycle physics, and to produce irradiated fuel for the development of Pu fuel chemical processing. The reactor complex is described in detail. The operating procedures, which are designed to maintain a high degree of reactor safety, are described. Reactor safeguards aspects of possible equipment malfunctions and failures are analyzed. ***N. G. Wittenbrock, P. C. Walkup, and J. K. Anderson, editors.*** *U. S. Atomic Energy Commission, HW-61236,* Oct. 1, 1959, 292 pp. (UF767 Un3.1hw Contin.)

4704 Heat Transfer in ETR Fuel Assemblies for Cycle 13. The neutron flux distribution was measured and the heat transfer calculations were re-examined for ETR Cycle 13 because several large experiments had been inserted in the ETR core. In addition, the importance of fuel core alloy thicknesses greater than the nominal was determined by calculation. ***V. A. Walker.*** *U. S. Atomic Energy Commission, IDO-16562,* Nov. 6, 1959, 24 pp. (UF767 Un3.1id Contin.)

4705 Los Alamos Molten Plutonium Reactor Experiment (LAMPRE) Hazard Report. The first experiment (LAMPRE I) in a program to develop molten Pu fuels for fast reactors is described and the hazards associated with reactor operation are discussed and evaluated. The reactor description includes fuel element design, core configuration, Na coolant system control, safety systems, fuel capsule charger, cover gas system and shielding. Information of the site comprises population in surrounding areas, meteorological data, geology, and details of the reactor building. The hazards discussion considers the probable consequences of loss of coolant pumping, electrical power failure, and the malfunction of the several elements comprising the reactor system. A calculation on the effect of fuel element bowing appears in an appendix. ***E. O. Swickard.*** *U. S. Atomic Energy Commission, LA-2327,* Dec. 28, 1959, 117 pp. (UF767 U3La Contin.)

4706 An IBM 704 Program for the Computation of Cross-Section in Gamma-Ray Zero-Zero Transitions in Nuclei. An IBM 704 program for the computation of the transition rates for the internal K-electron conversion and pair production processes in monopole nuclear transitions is described. The computations are based on formulas given by Thomas. Also, for the internal conversion transition rates, additional computations are made which are based on formulas stated by Reiner. ***Roger E. Mills and Robert M. Kloepper.*** *U. S. Atomic Commission, LAMS-2395,* Dec. 10, 1959, 17 pp. (UF767 Un3.1La Contin.)

4707 Processing Refabrication Experiment (PRE) Program Bibliography. Listing of all documents concerning the Pyroprocessing Refabrication Experiment (PRE), later renamed Processing Refabrication Experiment. ***G. L. Schalin.*** *U. S. Atomic Energy Commission, NAA-SR-3703,* Nov. 15, 1959, 13 pp. (UF767 Un3.1na Contin.)

4708 Neutron Moderation by Acoustic Modes of Metal Hydrides. The excitation by nuclear collisions of the acoustic modes of a metal hydride crystal was investigated, using a model of the crystal based on experiments on ZrH_2, but slightly more general. It is found that these modes contribute little to neutron moderation in ZrH_2. A generalized form of the Wilkins equation, which determines the spectrum of neutrons thermalizing in a heavy moderator, is developed, applicable when the scattering cross section varies with energy. ***E. U. Vaughan.*** *U. S. Atomic Energy Commission, NAA-SR-3788,* Dec. 1, 1959, 21 pp. (UF767 Un3.1na Contin.)

4709 Self-Sustaining Plutonium Recycle in Sodium Graphite Reactors. The analysis of the lattice requirements for achievement of self-sustaining Pu recycle in an SGR indicates that a high degree of neutron conservation is necessary. Specifically, a reactor which requires a U enrichment of 1 a/o U-235 or less, when Pu is not recycled, appears necessary. A factor of equal importance with the achievement of self-sustaining Pu recycle is the value of specific energy yield or U-235 burnup which may be attained. It appears technically feasible to design a SGR to operate on self-sustaining Pu recycle. ***T. J. Connolly.*** *U. S. Atomic Energy Commission, NAA-SR-3912,* Sept. 1, 1959, 45 pp. (UF767 Un3.1na Contin.)

4710 Evaluation of Fallout Data. By determination of the relative concentration of individual fission product isotopes, nuclear detonation debris can be identified and the time of fission determined without the necessity of taking extended decay measurements. Not only is this method very rapid but there is no interference by activity from other sources and no errors are introduced due to selective absorption in transport. ***A. A. Jarrett.*** *U. S. Atomic Energy Commission, NAA-SR-3972,* Dec. 1, 1959, 15 pp. (UF767 Un3.1na Contin.)

4711 Sodium Reactor Experiment (SRE) Shielding Evaluation for Thermal Neutron Streaming at Reactor Vessel Coolant Pipe Penetrations. Concerns analysis of neutron streaming at coolant pipe penetrations of the reactor vessel, analysis of shielding required, testing and evaluation of recommended shielding, and measurement and correlation of neutron streaming in labyrinths with theory. The activation analysis method using Zn sheets which was developed for the program of determining thermal neutron streaming in the SRE primary galleries was proven to be versatile, accurate, and reliable. A modified form of the theoretical method of Price, Horton, and Spinney, used to determine neutron scattering through labyrinths, was found to agree favorably with the experimental results obtained from thet SRE primary galleries. ***F. D. Anderson.*** *U. S. Atomic Energy Commission, NAA-SR-3990,* Oct. 31, 1959, 50 pp. (UF767 Un3.1na Contin.)

4712 Power Flattening in Sodium Graphite Reactors by Spatial Variation of Moderator Properties. A preliminary evaluation of the effectiveness of two power-flattening expedients, which have particular advantages in the case of solid-moderator, fixed-fuel power reactors, was made. These expedients are the variation of moderator composition with position in the core and variation of moderator density with position in the core. ***T. J. Connolly.*** *U. S. Atomic Energy Commission, NAA-SR-4180,* Dec. 15, 1959, 23 pp. (UF767 Un3.1na Contin.)

4713 Atomistic Interpretation of Radiation Effects in Metals. The present status of atomistic interpretations of radiation damage in metals is reviewed. Detailed consideration is given to radiation effects and associated lattice defect phenomena in Cu, since Cu has received the most extensive experimental and theoretical study. ***A. Sosin.*** *U. S. Atomic Energy Commission, NAA-SR-4301,* Dec. 1, 1959, 34 pp. (UF767 Un3.1na Contin.)

4714 Core Parameter Survey Report for Organic Cooled Reactors. All of the parameter variations represent perturbations of a reference organic cooled and moderated reactor plant design considered to be consistent with current technology. In addition to presenting the economics effects of core parameter perturbations, this report also presents an evaluation of cost reductions which may be attained by improvement of the organic reactor concept through technological developments. The parameter perturbation study was limited to parameters affecting the cost of the reactor, the cost of the primary heat transfer equipment, net fuel costs, and organic coolant

makeup costs. ***R. W. Hardy and B. L. Hoffman.*** *U. S. Atomic Energy Commission, NAA-SR-4510*, Dec. 15, 1959, 52 pp. (UF767 Un3.1na Contin.)

4715 Alloy Dispersion Fuel Elements. A survey was made of potential dispersion alloy fuel elements consisting of a U-containing, fissile, intermetallic phase dispersed in a non-fissile matrix. The intermetallic compounds considered were those of U with Fe, Ni, Al, Cu, Bi, and Si. On the basis of microstructure, oxidation resistance, and workability, the systems U-type 304 stainless steel and U - 80 Ni, 20 Cr were chosen for detailed study. Six alloy compositions were fabricated with enriched U for irradiation studies. ***J. Paul Pemsler.*** *U. S. Atomic Energy Commission, NMI-1223*, Nov. 17, 1959, 27 pp. (UF767 Un3.1nm Contin.)

4716 Solid State Division. Annual Progress Report for Period Ending August 31, 1959. Problems of the theory of radiation damage, of dislocation interactions, of low-temperature studies, of semiconductor studies, of insulating crystals, of radiation metallurgy are discussed in detail. ***D. S. Billington and J. H. Crawford, Jr.*** *U. S. Atomic Energy Commission, ORNL-2829*, Dec. 11, 1959, 227 pp. (UF767 U3o Contin.)

4717 The Fast Multiplication Effect of Beryllium Oxide in Reactors. The net multiplication effect of beryllium oxide, which is due to the (n, 2n) reaction, was calculated using an essentially exact calculation of the neutron spectrum as a function of energy. The upper limit of the (n, 2n) cross section curve gives the unpoisoned value $\epsilon^{+} = 1.047$ and the lower limit gives $\epsilon^{-} = 1.027$. ***W. Häfele and Marina Tsagaris.*** *U. S. Atomic Energy Commission, ORNL-2849*, Dec. 14, 1959, 20 pp. (UF767 U3o Contin.)

4718 The Lifetime and Decay Modes of Negative K Mesons. A large emulsion stack exposed to an enriched K^--meson beam analyzed by 180-deg. magnetic bending has been used to measure the mean lifetime and decay branching ratios of K^- mesons. Space angles were measured and momenta of secondaries were determined from their ranges or from blob-density measurements. The residual range accurately determined the K^--meson momentum at the decay point, because the 180-deg. bending provided high momentum resolution. ***Norris A. Nickols.*** *U. S. Atomic Energy Commission, UCRL-8692*, Sept. 1959, 50 pp. (UF767 U3u Contin.)

4719 Controlled Thermonuclear Research Quarterly Report, March, April, May, 1959. Problems of the pyrotron program, of high-energy injection, of the astron program, of the Livermore pinch program, of the Berkeley pinch program, of the ion magnetron, of theoretical research, of basic experimental research, and of engineering and technological development are discussed. *U. S. Atomic Energy Commission, UCRL-8775*, June 10, 1959, 102 pp. (UF767 U3u Contin.)

4720 Measurement of Radiative Lifetimes. Describes an apparatus for measurement of millimicrosecond radiative lifetimes of gas-phase molecules and gives an evaluation of the apparatus. The radiative lifetime of the B O^{+}_{u} state of I_2 by two absolute absorption methods is discussed. ***Fred Ezra Stafford.*** *U. S. Atomic Energy Commission, UCRL-8854*, Sept. 21, 1959, 126 pp. (UF767 U3u Contin.)

4721 Range and Range Straggling of Heavy Recoil Atoms. The range and range straggling of 96.8-kev Ra^{224} recoil atoms produced by α decay of Th^{228} have been measured in H_2, D_2, He, N_2, Ne, and A by a charged, parallel-plate, collection technique. The range and range straggling of 725-kev Th^{226} recoil atoms produced by bombardments of Ra^{226} with 41.6-Mev He ions have been measured in D_2, He, N_2, and A by this same technique. Experimental results seem to indicate that the range-energy relation for the stopping of heavy recoils by nuclear collisions is not linear, as is theoretically predicted by Bohr. ***Ernest William Valyocsik.*** *U. S. Atomic Energy Commission, UCRL-8855*, Nov. 1959, 43 pp. (UF767 U3u Contin.)

4722 Liquid-Hydrogen Target. A 48-in.-long liquid-hydrogen target is described. This report stresses the operating characteristics of the target and its safety features which follow the regulations laid down by the Hydrogen Safety Committee of the Lawrence Radiation Laboratory. ***Duane D. Newhart, Victor Perez-Mendez, and William L. Pope.*** *U. S. Atomic Energy Commission, UCRL-8857*, Aug. 18, 1959, 13 pp. (UF767 U3u Contin.)

4723 Charged-Particle-Induced Fission: A Mass Spectrometric Yield Study. Both U^{238} and U^{235} were bombarded with 45.7- and 24-Mev He ions, and U^{238} was also bombarded with 730-Mev protons and 100-Mev C ions. The broad and asymmetric-shaped independent yield distribution for higher-energy fission (730-Mev protons) with a given element was observed. This can be explained by the multiplicity of fissioning nuclei. ***Yung Yee Chu.*** *U. S. Atomic Energy Commission, UCRL-8926*, Nov. 1959, 75 pp. (UF767 U3u Contin.)

4724 Bevatron Operation and Development. XXI. K-mesons, antiproton, and θ_2°-particle decay and interactions. Nuclear emulsions were exposed for external groups to neutral particles, to antiproton and K^--meson beams, and to the primary proton beam. Deflected-beam studies were continued. The generator shafts were comprehensively surveyed; ultrasonic techniques were used to detect and record shaft discontinuities. ***Walter D. Hartsough.*** *U. S. Atomic Energy Commission, UCRL-8927*, Oct. 26, 1959, 22 pp. (UF767 U3u Contin.)

4725 Monte Carlo Methods and Their Application to Neutron Transport Problems. ***J. Spanier.*** *U. S. Atomic Energy Commission, WAPD-195*, July 1959, 65 pp. (UF767 Un3.1wa Contin.)

4726 The Calculation of Pressure Drop and Flow Distribution Within a Reactor Vessel in a Pressurized Water Nuclear Reactor System. A collection of formulas is presented for calculating the pressure drops and flow distribution within the non-reactive portion of a pressurized water nuclear reactor vessel. Numerous examples illustrate the use of the formulas presented. Calculations based on the information presented in this report have been found to agree well with experimental data. ***J. S. Busch, L. L. Lynn, C. F. Bonilla.*** *U. S. Atomic Energy Commission, WAPD-217*, Aug. 1959, 39 pp. (UF767 Un3.1wa Contin.)

4727 Recoil Range of Fission Fragments in Zirconium. The recoil ranges of fission fragments in Zr were measured by irradiating small pieces of a Zircaloy-2 ribbon containing 492 ppm of homogeneously dispersed U^{235}. The samples were wrapped in Al foil during the irradiation to catch the fission fragments escaping from the surface of the Zircaloy-2. Average values of 10.1 and 8.15 microns were obtained for the recoil ranges of the median light and heavy fission fragments, respectively; these values compare quite well with values calculated from empirical equations. ***E. R. Smith and P. W. Frank.*** *U. S. Atomic Energy Commission, WAPD-TM-198*, Nov. 1959, 5 pp. (UF767 Un3.1wa Contin.)

4728 Reports to the AEC Nuclear Cross Sections Advisory Group, Oak Ridge National Laboratory, Oak Ridge, Tennessee. These reports contain an informal statement of recent developments, changes of emphasis, and preliminary data which are of importance to the cross section measurement program of the AEC. Research work and developments at Argonne National Laboratory, Brookhaven National Laboratory, Columbia University, Duke University, Hanford Laboratories, Los Alamos Scientific Laboratory, Oak Ridge National Laboratory, Phillips Petroleum Company, Rice Institute, and University of California—Lawrence Radiation Laboratory are discussed. *U. S. Atomic Energy Commission, WASH-1026*, Oct. 28-29, 1959, 69 pp. (UF767 Un3lw Contin.)

4729 Optimizing the Ratio of Time Constant to Radiation Level for Precision Count-Rate Meters. When both accuracy and speed of response are required in the measurement of radiation level, a knowledge of the factors determining scatter is essential. A simple method of expressing the accuracy in terms of the integrating time and radiation level is developed. ***A. H. Fowler and R. A. McLean.*** *U. S. Atomic Energy Commission, Y-1278*, Apr. 27, 1959, 24 pp. (UF767 Un3.1y Contin.)

4730* Instrumentation of Nuclear Power Plants. Among the nuclear instruments are radiation detectors (ionization, fission and pulse chambers), pulse processing instruments (preamplifiers, discriminators, linear and logarithmic average value meters and amplifiers or electronic counters). Electronic

and magnetic critical value transmitters and control galvanometers are employed for the safety system. *(In German.)* Instrumentierung von Kernkraftwerken. ***L. Merz and G. Kourim.*** *VDI Zeitschrift*, v. 101, no. 31, Nov. 1, 1959, p. 1433-1447.

See also: **3890** (swaged-metal fiber-UO_2 fuel element); **4339** (nuclear explosions in peace); **4389** (atom powered aircraft); **4428** (atomic energy documentation); **4430** (atomic energy documentation); **4624** (hydrogen distribution in Zr cans of SRE).

OPERATIONS RESEARCH

4731* Strategy and Tactics of Executive Action. In his presentation, considered highly controversial by many members at the ASAE Convention, Boca Raton, Fla., Dr. Martin made it clear that his purpose was to give association executives an insight into the methods used by people in any kind of setting — business, educational, family, ecclesiastical, etc. He emphasized the importance of association executives being aware of the strategy and tactics of other people in order not to be caught napping, lest the work of their associations be vitiated or destroyed. ***Norman H. Martin.*** *ASAE Journal*, v. 12, no. 1, Jan. 1960, p. 91 + 6 pages.

4732* The Impact of Industrial Control Systems of Managerial Responsibility. Considers how far automation may assume the role of management itself and to what extent this would be desirable in the interests of efficiency. Managers will not become redundant merely because some of their routine functions are taken over by machines but they may need a certain amount of re-training. ***John B. Rudkin.*** *Automation Progress*, v. 4, Nov. 1959, p. 372-373.

4733 An Analysis of Adequate Inventory Levels. Analytical procedure for determining adequate stock levels for an inventory system with random demand and replenishment functions. ***J. J. Sopka.*** *IBM Journal of Research and Development*, v. 3, no. 1, Jan. 1959, p. 54-57.

4734* A Simplified Approach to Waiting Lines. Analyzes and explains queueing problems found in a service facility, with a minimum of mathematical language. ***Stuart L. Knowlton.*** *Journal of Industrial Engineering*, v. 10, no. 6, Nov.-Dec. 1959, p. 423-425.

4735* What Is an Organized Methods Improvement Program? The purpose of an organized methods improvement program is to provide assistance to management in making things "simple through system". The basic objective of methods improvement is to produce a product or service with less effort, in less time, without hurrying, with greater safety, and at lower costs. ***Warren R. Mellin.*** *Journal of Industrial Engineering*, v. 10, no. 6, Nov.-Dec. 1959, p. 426-432.

4736* Solving Linear Programming Problems With Variable Parameters. In this paper the author deals with the following question: "When a set of constants of the problem are changed (with or without necessitating a change of basis), what is the optimal solution?" ***C. M. Shetty.*** *Journal of Industrial Engineering*, v. 10, no. 6, Nov.-Dec. 1959, p. 433-438.

4737* Industrial Engineering Techniques and Operations Research. This paper presents in brief the historical development of the traditional techniques of industrial engineering, shows by a simple example the contribution of operations research, and briefly surveys some of the other analysis techniques of use to the industrial engineer. ***Eugene Richman and Sylvain Ehrenfeld.*** *Journal of Industrial Engineering*, v. 10, no. 6, Nov.-Dec. 1959, p. 439-445.

4738* Estimating Load Requirements in a Job Shop. Generally a multiple linear estimation function will be required for accurate estimates of the load requirement for individual orders, although the total load requirement for a group of orders can be closely estimated from a single strongly correlated variable. The problem discussed is that of estimating the time required to build up the laminations forming the core of a shell-type power transformer. ***Francis L. Canning.*** *Journal of Industrial Engineering*, v. 10, no. 6, Nov.-Dec. 1959, p. 447-449.

4739* An Unusual Work Sampling Application. It is not common practice to investigate the work habits of a college faculty, much less to learn of these habits by means of the work sampling technique. Yet this is precisely what has been done in this particular study. ***John A. Ritchey.*** *Journal of Industrial Engineering*, v. 10, no. 6, Nov.-Dec. 1959, p. 450-455.

4740* The Effect of Hypergeometric Probability Distribution on the Design of Sampling Plans for Small Lot Sizes. ***A. E. Rokhsar and G. E. Kane.*** *Journal of Industrial Engineering*, v. 10, no. 6, Nov.-Dec. 1959, p. 467-469.

See also: **4419** (human factors information systems); **4420** (human factors information systems).

ORE AND MATERIALS BENEFICIATION

4741 Reactions in Pelletizing and Iron-Ore Reduction. ***J. O. Edström.*** *Henry Brutcher Translation No.* 4638, 37 pp. (From *Jernkontorets Annaler*, v. 142, no. 7, 1958, p. 428-466). Henry Brutcher, Altadena, Calif.

4742 Cyanamid Flocculants. 20 pp. 1959. (Pamphlet File)

4743 Separating Hafnium From Zirconium. Gives a process flow sheet. *Engineering and Mining Journal*, v. 161, Jan. 1960, p. 78-79.

4744 Economic Aspects of Direct Reduction of Iron Ore in Illinois. Direct reduction of Fe ore may be used to increase the capacity of either old or new plants to produce material that can be substituted for scrap Fe in the charge to the open hearth furnace or to enrich a normal blast furnace charge. ***W. H. Voskuil and H. E. Risser.*** *Illinois State Geological Survey, Circular* 283, 1959, 19 pp. (TN21 IL6.7c Vis.)

4745* Uranium Recovery at Rum Jungle. Solid-liquid separation is carried out using conventional counter-current decantation followed by filtration and the resultant pregnant liquor is purified by ion exchange. The U is precipitated with magnesia to give a 70% concentrate which is dried and packed in drums ready for shipment to the Combined Development Agency. *Mine & Quarry Engineering*, v. 25, Dec. 1959, p. 522-531.

4746* Centrifuging Stoker Coal. Dewatering stoker coal in centrifugal dryers to the point that it can be shipped without further drying. ***E. A. Watters, Jr.*** *Mining Congress Journal*, v. 46, Jan. 1960, p. 39-41.

4747* Mineral Dressing: Old and New. Traces the development of the art over 50 years. ***E. J. Pryor.*** *Mining Magazine*, v. 101, no. 6, Dec. 1959, p. 297-318.

4748* Extraction and Purification of Thorium. Extraction of Th from monazite; extraction of Th from oxide and silicate minerals; health hazards in Th processing. ***A. W. Wylie.*** *Reviews of Pure and Applied Chemistry*, v. 9, no. 3, Sept. 1959, p. 169-212.

4749 The Effect of Uranium Saturation on the Extraction of Elements Other Than Uranium Into Tributyl Phosphate. Results indicate that decontamination can be markedly increased under conditions of high U saturation. ***G. P. Lang and J. T. Krieg.*** *U. S. Atomic Energy Commission, MCW-*1440, Jan. 4, 1960, 20 pp. (UF767 Un3.1mc Contin.)

4750 Modified Zirflex Process for Dissolution of Zirconium- and Niobium-Bearing Nuclear Fuels in Aqueous Fluoride Solutions: Laboratory Development. Flowsheets were developed for recovering U from the newer power reactor fuel alloys after discharge from the reactor. In one process, ammonium hydroxide is added to produce insoluble hydrous oxides of U, Zr, and Nb. The NH_4F-NH_4OH super-

natant is removed by filtration, partially evaporated, and recycled as dissolvent. The U and Zr oxides are dissolved in nitric acid to yield a solvent extraction feed solution of low fluoride content. Another process using nitric acid and aluminum nitrate is also described. ***T. A. Gens and F. G. Baird.*** *U. S. Atomic Energy Commission, ORNL-2713,* Dec. 22, 1959, 30 pp. (UF767 U3o Contin.)

4751 Recovery of Uranium From Chattanooga Shale. The ion exchange process; cost estimates; and application to shale leach liquors. *U. S. Atomic Energy Commission, RMO-4017,* Sept. 1959, 54 pp. (UF767 U3r Contin.)

4752 Milling and Processing Tungsten. Presents the technologic status and the problems encountered in milling and processing W ores. Summarizes milling practices and chemical treatment methods used at most of the major and at a number of smaller domestic W operations. ***J. B. Zadra.*** *U. S. Bureau of Mines Information Circular* 7912, 1959, 120 pp. (TN21 Un3i Vis.)

4753 Flocculation as an Aid to Filtration of Coal Slurry. Sixteen flocculants are studied. ***M. R. Geer, P. S. Jacobsen, and H. F. Yancey.*** *U. S. Bureau of Mines Report of Investigations* 5535, 1959, 22 pp. (TN21 Un3r Vis.)

See also: **3901** (pyrite sulfuration).

PHYSICS

4754 A New High Frequency Mass Spectrometer and Its Use in High Vacuum Technology. In continuation of investigations on the ultimate pressure of high-vacuum pumps, a new mass spectrometer has been developed which, in contrast to the omegatron, provides reliable analyses also at high pressures. The working range of this high frequency mass spectrometer of Váradi, which in many respects resembles the type described by Bennett, is between 1×10^{-7} and 5×10^{-4} mm Hg (Torr). A report is given on measurements carried out on a two-stage Roots pump, and on processes that take place in aluminizing at pressures of several times 10^{-4} mm Hg (Torr). ***K. Diels and H. Moesta.*** Paper from "American Vacuum Society, Inc., 1958, Vacuum Symposium Transactions", Pergamon Press, New York. 1959, p. 115-117. (QC166 C73v Over.)

4755* Modified Bohm and Pines Collective Description of Electron Interactions in Crystals. Spin Wave Theory of Ferromagnetism. III. The Bloch spin wave theory of ferromagnetism is presented. Starting from the hamiltonian in the Bohm-Pines representation, the author obtains the Slater-Bloch equations and formulae for mean magnetization for three types of cubic lattices. All the calculations are made on assumption that the atoms are monovalent. ***Jan Śledzik.*** *Acta Physica Polonica,* v. 18, no. 4, 1959, p. 295-306.

4756* How Stands the Theory of Gravitation Today? *J. L. Synge.* *Advancement of Science,* v. 14, Dec. 1957, p. 207-214.

4757 Certain Matters in Relation to the Restricted Theory of Relativity, With Special Reference to the Clock Paradox and the Paradox of the Identical Twins. I. Fundamentals. Discusses significance of the meaning of space-time coordinates as attached to "events" in the Lorentzian transformation. Restricted relativity involves two distinct parts: A—the invariance of the forms of the laws under the transformation; B—the hypothesis that similar experiments performed in relatively moving frames S and S′ give identical results. ***W. F. G. Swann.*** *American Journal of Physics,* v. 28, no. 1, Jan. 1960, p. 55-64.

4758 Influence of the Environment on the Wave Transmission of Energy: Resonance and Relaxation. Reviews the influence of the environment on the emission and absorption of radiation energy, both elastic and electromagnetic. Attention is called to the loading of wave sources which is independent of frequency. Of those influences which are frequency dependent, resonance and relaxation are the most important. These are compared and their similarities and differences noted. ***R. B. Lindsay.*** *American Journal of Physics,* v. 28, no. 1, Jan. 1960, p. 67-75.

4759 Basic Data of Plasma Physics. A combination of the most recent class notes and current basic data technical report, prepared specifically for an M.I.T. course in plasma dynamics given during the summer of 1959. No attempt has been made to make this volume a complete text on gas discharge physics. ***Sanborn C. Brown.*** 336 pp. 1959. The Massachusetts Institute of Technology and John Wiley & Sons, Inc., New York. (QC711 B81b)

4760 Some Aspects of the Design of Large Permanent Magnets. This paper considers the design and construction of a large permanent magnet for use in cosmic ray studies. It is shown that there is an optimum distribution of the magnetic material in order to obtain either a maximum field or a maximum line integral for a given pole face area and gap size. ***J. E. Cousins and W. F. Nash.*** *British Journal of Applied Physics,* v. 10, Nov. 1959, p. 471-475.

4761 Efficiency of Characteristic $K\alpha$ X-Ray Production in Copper Between 9 and 15 kV. Absolute measurements are described and the data are compared with existing information. ***N. A. Dyson.*** *British Journal of Applied Physics,* v. 10, Nov. 1959, p. 505-507.

4762* Interferometric Studies on Oscillating Quartz Crystals. Multiple-beam interferometry has been used in elegant experiments to reveal the modes of vibration of quartz crystals. The technique has been combined with stroboscopy, successfully achieved at frequencies measured in megacycles. ***S. Tolansky.*** *Discovery,* v. 20, Dec. 1959, p. 528-535.

4763 Phosphors and Their Uses. In general, lamp phosphors are inorganic silicates, borates, tungstates, and phosphates, usually activated by Mn, Sb, Sn, or Pb. "Panelescent" lamps are made by imbedding the phosphors in a ceramic glaze resulting in years of continuous service at low cost. ***David F. Fortney.*** *Electronics World,* v. 62, no. 6, Dec. 1959, p. 50 + 2 pages.

4764 Electron Physics. The Physics of the Free Electron. The production of cathode rays, electron motion, electron optics, electronic space charge and the flow of electrons, the detection of cathode rays, the charge of the electron, the charge to mass ratio (e/m) of the electron, the electron mass and its relativistic change, the wave nature of the electron, the spin and the magnetic moment of the electron are discussed. ***O. Klemperer.*** 248 pp. 1959. Academic Press Inc., New York. (QC721 K67e)

4765 Exploding Wires. Records the papers of the Conference on the Exploding Wire Phenomenon conducted by the Air Force Cambridge Research Center in Boston, Massachusetts, on April 2 and 3, 1959. ***William G. Chace and Howard K. Moore, editors.*** 373 pp. 1959. Plenum Press, Inc., New York. (QC601 C34e)

4766 Ferrites. Physical Properties of Ferrimagnetic Oxides in Relation to Their Technical Applications. Properties and origin of magnetic fields in matter, theory of ferromagnetism, ferrimagnetism, magnetic anisotropics, magnetization processes, dynamics of magnetization processes, methods of measuring ferromagnetic properties, intrinsic properties of ferrites with spinel structure and other problems. ***J. Smit and H.P.J. Wijn.*** 369 pp. 1959. John Wiley & Sons, New York. (QC761 Sm49f)

4767* Slow Decay Rates of Phosphors in Fluorescent Lamps. Most phosphors have a two-fold decay. There is a very fast decay which reaches completion in a few microseconds followed by a relatively slow decay. The rate of decay of the Mn-activated phosphors is modified over a considerable range by the crystal matrix making up the phosphor. ***Charles W. Jerome.*** *Illuminating Engineering,* v. 54, Dec. 1959, p. 769-773.

4768 Time-Dependent Electron Flow. The conditions of self-consistency for electron flow through arbitrary static or time-varying electric and magnetic fields are established assuming (a) nonrelativistic flow, (b) single streaming—i.e., the

velocity has a single value and direction at every point, and (c) the electrons originate on a cathode not threaded by magnetic lines of force. In the case where the magnetic field is constant and uniform, a single-vector differential equation can be written which determines all possible solutions. ***M. C. Pease.*** *Journal of Applied Physics*, v. 31, Jan. 1960, p. 70-76.

4769 Asymmetrical Triple Probe Method for Determining Energy Distribution of Electron in Plasma. Proposes a new method which is an improvement of the floating triple probe method, proposed by the authors in a previous paper. In this method, the dimension of one operating probe is different from the other, so that the smaller probe behaves as the single probe. The asymmetrical triple probe method has a merit that a disturbance, which is inevitable in the single probe method, can be eliminated in this method. ***Takayoshi Okuda and Kenzo Yamamoto.*** *Journal of Applied Physics*, v. 31, Jan. 1960, p. 158-162.

4770 Use of the Self-Consistent Field in the Treatment of the Vibrations of Crystals. It is shown that quantum-mechanical average equilibrium positions and average normal coordinates of ordered crystals are useful quantities. It is found that the wave functions calculated using these average quantities are more tractable approximations than those calculated from the true potential function with neglect of cubic and higher terms. A self-consistent field treatment is used to show how the average equilibrium positions and average normal coordinates could be obtained in principle. ***Thomas H. Walnut.*** *Journal of Chemical Physics*, v. 31, Dec. 1959, p. 1468-1470.

4771 Lectures in Theoretical Physics. v. I. Lectures Delivered at the Summer Institute for Theoretical Physics, University of Colorado, Boulder, 1958. Includes lectures on: pair production and bremsstrahlung in the field of an atom, theory of particles with zero rest -mass, strange particles and their interactions, some aspects of the statistical-mechanical theory of irreversible processes, multiple production of mesons and a nonlocal theory of fields, selected topics in nuclear theory, and high-energy collision theory. ***Wesley E. Brittin and Lita G. Dunham, editors.*** v. I. 414 pp. 1959. Interscience Publishers, New York. (QC3 C71L)

4772 Manual of Mathematical Physics. The goal of this book is to condense established theoretical physics, its applications and its mathematical equipment into a single reference volume of reasonable size without sacrificing either logical continuity or fundamentals. ***Paul I. Richards.*** 486 pp. 1959. Pergamon Press, New York. (QC20 R39m)

4773* The Energy Dependence of the Polarization of Electrons and Time Parity. New measurements of the energy dependence of the polarization of the β-electrons from RaE show no significant violation of time parity. ***A. I. Alikhanov, G. P. Eliseyev, and V. A. Luibimov.*** *Nuclear Physics*, v. 13, no. 4, Nov. 1959, p. 541-548.

4774 Continuous Emission of Hydrogen Plasmas. Shows that for certain temperatures and pressures the continuous emission becomes so strong that the blackbody intensity of the corresponding temperature is reached for all wavelengths under consideration. This makes the plasma, in particular, useful for photolysis work and absorption spectroscopy. ***Frithjof Mastrup.*** *Optical Society of America, Journal*, v. 50, Jan. 1960, p. 32-35.

4775 Light Sources and Color Rendering. Light sources for many problems in agriculture and industry require good color rendering; standards are needed for both special and general purpose lamps. Target standards are discussed, and color, relative spectral distributions, and lumen efficiency data are provided for typical incandescent and fluorescent lamps. ***Dorothy Nickerson.*** *Optical Society of America, Journal*, v. 50, Jan. 1960, p. 57-69.

4776 Diffraction of Light by a Three-Dimensional System of Ultrasonics. A system of linear and homogeneous equations describing the phenomenon is set up and solutions found by a perturbation method. It is also shown why diffraction patterns are observed when experiments are performed with "monochromatic" light. ***P. Phariseau.*** *Physica*, v. 25, Oct. 1959, p. 924-934.

4777 The "Two Fluid" Model in the Classical Kinetic Theory of Gases. The author studies the conditions under which the classical model of diffusion is no longer suitable for explaining the dynamical behavior of gaseous mixtures and has to be replaced by a "two fluid" model of the type used in helium II at very low temperatures. He shows that such conditions, although exceptional, can nevertheless exist in certain ionized plasmas for high kinetic temperatures of the electrons. *(In French.)* Le modèle "deux fluides" dans la théorie cinétique classique des gaz. ***P. Glansdorff.*** *Physica*, v. 25, Oct. 1959, p. 988-1000.

4778 Ionized-Impurity Scattering Mobility of Electrons in Silicon. Curves have been obtained of the temperature dependence of the electron mobility in a set of *n*-type Si samples of varying impurity content and compensation between about 30 and 100 K by combining data from electrical resistivity and Hall effect measurements. The curves have been used in an experimental test of the applicability of the Brooks-Herring formula to the ionized-impurity scattering of electrons in Si under conditions for which the Born approximation is valid. ***Donald Long and John Myers.*** *Physical Review*, v. 115, 2nd ser., no. 5, Sept. 1, 1959, p. 1107-1118.

4779 Many-Particle Approach to the One-Electron Problem in Insulators and Semiconductors. A formal theory of one-electron states in insulators and semiconductors is developed from a many-particle point of view. The techniques of second quantization are utilized for this purpose in a manner analogous to that introduced recently for the study of Fermi liquids, i.e., by the study of matrix elements of the electron field operator which describe the propagation of particles or holes. ***Abraham Klein.*** *Physical Review*, v. 115, 2nd ser., no. 5, Sept. 1, 1959, p. 1136-1146.

4780 Photoconductivity of Gallium Selenide Crystals. Single crystals of GaSe have been prepared by reaction of the elements, followed by gradient freeze crystallization. The absorption edge of GaSe is at 6310 A, corresponding to a band gap of 1.97 ev; the temperature coefficient of band gap is about -4×10^{-4} ev/deg. Insulating and photosensitive GaSe crystals can be prepared by compensating the acceptor impurities by incorporated donors from Groups VII or IV. Rectification tests indicate *p*-type photoconductivity. ***Richard H. Bube and Edward L. Lind.*** *Physical Review*, v. 115, 2nd ser., no. 5, Sept. 1, 1959, p. 1159-1164.

4781 Application of Wave Functions Containing Interelectron Coordinates. I. The Ground-State Energy of Lithium. In this paper, the Pluvinage method is modified in such a way that it can be applied with a reasonable amount of labor to more complex systems. In this modification, the nuclear coordinates act like Fermi-Dirac "particles" filling the energy levels pairwise, while the interelectron coordinates act like Bose "particles", all of which pile into the lowest energy continuum state. An accurate approximation technique is also developed for use in integrating functions containing three or more interelectron coordinates over the space of the nuclear coordinates. The modified Pluvinage approach is used in conjunction with the approximation technique to calculate the ground-state energy of neutral Li. ***Peter Walsh and Sidney Borowitz.*** *Physical Review*, v. 115, 2nd ser., no. 5, Sept. 1, 1959, p. 1206-1215.

4782 Stark Broadening of Hydrogen Lines in a Plasma. The frequency distributions of hydrogen lines broadened by the local fields of both ions and electrons in a plasma are calculated in the classical path approximation. The electron collisions are treated by an impact theory which takes into account the Stark splitting caused by the quasi-static ion fields. The ion field-strength distribution function used includes the effect of electron shielding and ion-ion correlations. Good agreement with experimental Hβ profiles is obtained while there are deviations of factors of two with the usual Holtsmark theory. ***Hans R. Griem, Alan C. Kolb, and K. Y. Shen.*** *Physical Review*, v. 116, 2nd ser., no. 1, Oct. 1, 1959, p. 4-16.

4783 Multipole Singularities of Classical Vector and Pseudovector Fields. Establishes forms of the multipole moments of arbitrary order compatible with these equations, and also of the moments compatible with the more restrictive interactions proposed by Harish-Chandra, which include those of

electrodynamics as a special case; they are established under the assumption that the spin of the particle is of constant magnitude and has only spatial components in the rest system, and for pure $2n$-pole moments of constants magnitude ("intrinsic moments") or of variable magnitude ("induced moments," acceleration-dependent forces). ***Peter Havas.*** *Physical Review*, v. 116, 2nd ser., no. 1, Oct. 1, 1959, p. 202-217.

4784 On the Quantum Theory of the Third Virial Coefficient. The quantum theory of the third virial coefficient C is discussed. Three types of intermolecular pair forces must be distinguished. (1) No bound or low-lying two- and/or three-body states exist. The first four terms of the low-temperature expansion of C_{BE} are obtained. (2) Existence of a near zero energy level both for the two- and the three-body system. (3) Existence of strongly bound two- and three-body states. ***A. Pais and G. E. Uhlenbeck.*** *Physical Review*, v. 116, 2nd ser., no. 2, Oct. 15, 1959, p. 250-269.

4785 Ground-State Energy and Excitation Spectrum of a System of Interacting Bosons. Properties of a boson gas at zero temperature are investigated by means of field-theoretic methods. Difficulties arising from the depletion of the ground state are resolved in a simple way by the elimination of the zero-momentum state. The result of this procedure when applied to the calculation of the Green's functions of the system is identical to that of Beliaev. It is then shown generally that for a repulsive interaction the energy $E(k)$ of a phonon of momentum k, which is found as the pole of a one-particle Green's function, approaches zero for zero momentum, which means that the phonon spectrum does not exhibit an energy gap. Discusses the intermediate-density calculation of Brueckner and Sawada, and certain possible improvements in the method of summing a selected set of higher-order terms are proposed. ***N. M. Hugenholtz and D. Pines.*** *Physical Review*, v. 116, 2nd ser., no. 3, Nov. 1, 1959, p. 489-506.

4786 Slow Electrons in Polar Crystals: Self-Energy, Mass, and Mobility. The parameters for the Feynman model of a polaron are evaluated numerically for various values of the electron lattice interaction α, in the usual idealization of the problem of a slow electron in a polar crystal. The self-energy and effective mass thus obtained are compared with earlier polaron theories, indicating the superiority of the Feynman model for a wide range of α. The polaron size and the effect of the continuum approximation are estimated, and it is concluded that the alkali halides, at least, may be in the border region for the validity of this approximation. ***T. D. Schultz.*** *Physical Review*, v. 116, 2nd ser., no. 3, Nov. 1, 1959, p. 526-543.

4787 Exciton Spectrum of Cadmium Sulfide. The reflectance and fluorescent spectra of hexagonal CdS crystals were measured at 77 and 4.2 K using polarized light in the region of 5000 A. Structure not previously reported has been found in the reflectivity curves which leads to the identification of three exciton series. These can be understood in terms of the splitting of the valence band into three levels at $k=0$. The observation of excited exciton states and the polarization properties of the excitons make possible: (1) The determination of two of the three exciton binding energies, (2) the determination of the energy splittings of the three valence bands, (3) the verification of the symmetry assignments of the valence and conduction bands, and (4) correlation of the work of others with the present work, showing that the definite intrinsic effects are consistent both with our observations and our interpretations. The fluorescent experiments strongly suggest that the radiative decay of excitons occurs not directly, but from localized impurity exciton states in agreement with theory. ***D. G. Thomas and J. J. Hopfield.*** *Physical Review*, v. 116, 2nd ser., no. 3, Nov. 1, 1959, p. 573-582.

4788* Relative Intensities of Zeeman Components in Nuclear Quadrupole Resonance Spectrum. The transition probabilities for the Zeeman components in nuclear quadrupole resonance spectrum were formulated in the case of arbitrary field gradient. When a magnetic field is applied in a direction perpendicular to the principal z-axis in the case of nonaxial field gradient due to the surrounding charges, the inner pair of the Zeeman components is produced by the x-component of the rf field and the outer pair by the y-component. ***Masaharu Toyama.*** *Physical Society of Japan, Journal*, v. 14, Dec. 1959, p. 1727-1738.

4789* Ion-Electron Relaxation of Plasmas in a Strong Magnetic Field. I. Relaxation between ion and electron temperatures, T_1 and T_2, of dilute fully ionized gases in a magnetic field is discussed. The mean gyration radius, r_g, is assumed to be much smaller than the Debye length, l_D. ***Taro Kihara.*** *Physical Society of Japan, Journal*, v. 14, Dec. 1959, p. 1751-1754.

4790 A Self-Consistent Calculation of the Graphite π Band. The approximate self-consistent field theory, recently developed in calculations of molecular wave functions, is applied to a two-dimensional crystal—the graphite layer. The results, besides being of intrinsic interest, suggest that with the further development of automatic computation similar calculations on three-dimensional crystals will become feasible. ***T. E. Peacock and R. McWeeny.*** *Physical Society, Proceedings*, v. 74, pt. 4, Oct. 1, 1959, p. 385-394.

4791 Electron Loss From Fast Negative Ions of Atomic Hydrogen Passing Through Atomic Hydrogen. Born's approximation is used to calculate the cross sections at impact energies between 2·5 kev and 10 Mev. The sensitivity of the cross section to the choice of bound and free H^- wave function is examined. ***M. R. C. McDowell and G. Peach.*** *Physical Society, Proceedings*, v. 74, pt. 4, Oct. 1, 1959, p. 463-472.

4792 Progress in Dielectrics. This is the first of an annual series of volumes. Each volume will consist of about eight critical reviews surveying the present state of knowledge in selected aspects of the main subject. Many of the articles will contain a significant amount of original work. ***J. B. Birks and J. H. Schulman, editors.*** v. I. 312 pp. 1959. Heywood & Company, Ltd., London. (QC585 P94)

4793* $2\,^{3,1}P$ State of Helium Atom. The fairly accurate eigenfunctions of $2\,^3P$ and $2\,^1P$ states of the He atom are determined by the variation method so as to assume the simplest analytical form. The polarization of the s-orbital is taken into account, and the configuration interaction is examined. ***Gentaro Araki, Koichi Mano, and Masao Ohta.*** *Progress of Theoretical Physics*, v. 22, no. 4, Oct. 1959, p. 469-484.

4794 Electromagnetic Diffraction in Optical Systems. I. An Integral Representation of the Image Field. II. Structure of the Image Field in an Aplanatic System. An integral representation is obtained for the electromagnetic field in the image space of an optical system. This representation, which is not restricted to systems of low angular aperture, is in the form of an angular spectrum of plane waves, and is closely related to that introduced by Luneberg (1944) as a vector generalization of well-known formulae of Debye (1909) and Picht (1925). An investigation is made of the structure of the electromagnetic field near the focus of an aplanatic system which images a point source. First, the case of a linearly polarized incident field is examined and expressions are derived for the electric and magnetic vectors in the image space. Some general consequences of the formulae are then discussed. In particular the symmetry properties of the field with respect to the focal plane are noted and the state of polarization of the image region is investigated. I. ***E. Wolff.*** II. ***B. Richards and E. Wolf.*** *Royal Society, Proceedings*, v. 253, ser. A, Dec. 15, 1959, p. 349-379.

4795 Theory of Relativity. The foundations of the special theory of relativity, mathematical tools, further elaborations, general theory of relativity, and theories on the nature of charged elementary particles are discussed. ***W. Pauli.*** 241 pp. 1958. Pergamon Press, New York. (QC6 P28rtr)

4796 Thermodynamics and Statistical Thermodynamics. ***John Geldart Aston and James John Fritz.*** 556 pp. 1959. John Wiley & Sons, New York. (QC311 As86t)

4797 The Special Theory of Relativity. Space and time in inertial systems, three-dimensional tensors, Maxwell's theory in tensor formulation, general field theory, relativistic particle dynamics, elements of hydrodynamics, spinors are discussed. ***J. Aharoni.*** 285 pp. 1959. Oxford University Press, London. (QC6 Ah15s)

4798* Multiple Ionization of Rare Gases by Electron Impact. Impact studies in helium, neon, argon, and xenon appear to support theoretical conclusions that the threshold

probability for n-fold ionization is proportional to the nth power of the electron energy in excess of the threshold energy. For the cases studied, the probability law applies over a considerable energy range that, for all but He^{2+}, includes the possible onset of more than one mode of ionization. The presence of a Boltzmann spread in the energy of the electron beam is also studied. ***M. Krauss, R. M. Reese, and V. H. Dibeler.*** *U. S. National Bureau of Standards, Journal of Research, Section A, Physics and Chemistry,* v. 63, no. 3, Nov.-Dec. 1959, p. 201-204.

4799* Analysis of the First Spectrum of Ruthenium (Ru I). The analysis has been extended with the aid of digital computers. A total of 105 even and 206 odd levels are listed with observed Landé g-factors for 54 even and 148 odd levels. A complete list of approximately 3,400 classified lines in the range 2013 to 11484 A is presented. The ionization limit calculated from a two member series is 59410 cm^{-1} or 7,364 v. ***K. G. Kessler.*** *U. S. National Bureau of Standards, Journal of Research, Section A, Physics and Chemistry,* v. 63, no. 3, Nov.-Dec. 1959, p. 213-251.

4800* A Preliminary List of Levels and g-Values for the First Spectrum of Thorium (Th I). The present state of the analysis is discussed briefly. Even and odd levels are listed in tables 1 and 2. The low even levels form terms arising from the configurations $6d^2\ 7s^2$ and $6d^2\ 7s$. The Th I standard wavelengths that fit into the known level arrays are presented in table 3. ***Romuald Zalubas.*** *U. S. National Bureau of Standards, Journal of Research, Section A, Physics and Chemistry,* v. 63, no. 3, Nov.-Dec. 1959, p. 275-278.

See also: **4267** (magnetodynamics of conducting fluids).

PLASTICS

4801* Wear and Friction of Filled Polytetrafluoroethylene Compositions in Liquid Nitrogen. Data were obtained in liquid nitrogen (−320 F) with a series of molded and extruded polytetrafluoroethylene (PTFE) compositions containing various filler materials. Low wear and friction values are reported. ***Donald W. Wisander, Charles E. Maley, and Robert L. Johnson.*** *ASLE Transactions,* v. 2, no. 1, Apr. 1959, p. 58-66.

4802* Castor Oil-Derived Plasticizers. Some Nitrogen-Containing Derivatives as Plasticizers for Vinyl Chloride-Vinyl Acetate Copolymer and Cellulose Acetate Resins. Screening of derivatives of ricinoleic acid (12-hydroxy-9-octadecenoic acid, the principal component of castor oil) as primary plasticizers for vinyl chloride-vinyl acetate copolymer resin. ***Frank C. Magne, Harold P. Dupuy, and Leo A. Goldblatt.*** *American Oil Chemists' Society, Journal,* v. 36, Dec. 1959, p. 635-637.

4803* Plasticizer Properties of Methyl Vinyl Ketone-Methyl *alpha*-Eleostearate Adduct and Derivatives. Preparation of derivatives and an intercomparison of the plasticizer properties of these derivatives and the parent compound with those of di-2-ethylhexyl phthalate. ***Lida L. Placek, Frank C. Magne, and W. G. Bickford.*** *American Oil Chemists' Society, Journal,* v. 36, Dec. 1959, p. 651-652.

4804* The Cyanoethylation and Infrared Spectra of Some Ricinoleic Acid Derivatives. Five ricinoleic acid derivatives have been cyanoethylated with acrylonitrile, namely, 4-ricinoleoylmorpholine, 4-ricinelaidoylmorpholine, 4-(12-hydroxystearoyl) morpholine, 1,12-dihydroxy-9-octadecene and 1,12-dihydroxyoctadecane, using benzyltrimethylammonium hydroxide as a cyanoethylation catalyst and water to retard the polymerization of acrylonitrile. ***H. P. Dupuy, Roberto Calderon, E. R. McCall, R. T. O'Connor, and L. A. Goldblatt.*** *American Oil Chemists' Society, Journal,* v. 36, Dec. 1959, p. 659-663.

4805 Toughening Thermoplastic Resins With Rubbers. A review of the problems involved in toughening and some of the answers which have been put forward. ***N. E. Davenport, L. W. Hubbard, and M. R. Pettit.*** *British Plastics,* v. 32, Dec. 1959, p. 549-556.

4806* Polymerization of Methyl Methacrylate Initiated by Phenylazo *p*-Tolyl Sulfone. Results of experiments about the relation between the initial rate of polymerization and the concentrations of phenylazo p-tolyl sulfone, dimethylaniline, and methyl methacrylate are given, and the nature of the initiating reaction is discussed from the standpoint of the reaction kinetics. ***Ryoichi Uehara.*** *Chemical Society of Japan, Bulletin,* v. 32, no. 11, Nov. 1959, p. 1199-1202.

4807 Polymerisation of Acetylene Derivatives. III. Polymerisation of a Dimer of 4-Penten-2-yn-1-ol and Attempted Polymerisation and Copolymerisation With Styrene of 1:1:3:3:6-Pentamethyl-4-*iso*propenyl*iso*coumaran, 1:4-Di-*p*-chlorophenoxy-2-butyne, and 2-Methyl-2-*iso*propenyl-4-methyloldioxolan. ***A. C. Davis and R. F. Hunter.*** *Journal of Applied Chemistry,* v. 9, pt. 12, Dec. 1959, p. 660-665.

4808* The Sorption of Water by Nylons. Sorption isotherms of annealed films of nylons 66 and 610 at 23 C are described by the Flory-Huggins equation at all humidities. The partial specific volume of water varies from 0.46 cc/g at 0% RH to more than 1.0 cc/g at 100% RH. ***Howard W. Starkweather, Jr.*** *Journal of Applied Polymer Science,* v. 2, no. 5, Sept.-Oct. 1959, p. 129-133.

4809* The Effect of Radiation on Poly-α-Methylstyrene. Degradation studies at 25 C under vacuum and in H_2 and O_2 were carried out with the use of a Co^{60} gamma source. The degradation results are explained as a random breaking of skeletal chain bonds accompanied by a depropagation of the resulting fragments. ***Abraham M. Kotliar.*** *Journal of Applied Polymer Science,* v. 2, no. 5, Sept.-Oct. 1959, p. 134-142.

4810* Effects of Corona Discharge Upon Polyethylene. Supporting evidence for the electron bombardment mechanism for the degradation of dielectric materials by corona discharge was obtained by correlating the maximum radius of oxidized product, oxalic acid, produced by corona discharge from a spherical electrode upon polyethylene, with the theoretical range of electrons produced. ***R. F. Grossman and W. A. Beasley.*** *Journal of Applied Polymer Science,* v. 2, no. 5, Sept.-Oct. 1959, p. 163-165.

4811* Density, Crystallinity, and Heptane Insolubility in Isotactic Polypropylene. Measurements of the density show that the specific volume is linearly related to per cent crystallinity as determined from X-ray data. ***R. G. Quynn, J. L. Riley, D. A. Young, and H. D. Noether.*** *Journal of Applied Polymer Science,* v. 2, no. 5, Sept.-Oct. 1959, p. 166-173.

4812* Spectra of Irradiated Polyamides. Differential spectra indicate that both free radical and molecular products are produced as primary products. The transient colored products and molecular products appear to be in the amine portion of the molecule for the most part. The approximate G yield for radical production in nylon 66 is 5.8, and the approximate molar extinction coefficient of the free radical at 355 mμ is 690. ***Joseph Zimmerman.*** *Journal of Applied Polymer Science,* v. 2, no. 5, Sept.-Oct. 1959, p. 181-185.

4813* Polyesters of Hydroxybenzoic Acids. Polymers and copolymers prepared from the acetoxy derivatives of m- and p-hydroxybenzoic acids. Molecular weights of over 20,000 were obtained for poly(m-hydroxybenzoic acid) and copolymers containing up to 60% *para* isomer. ***Russell Gilkey and John R. Caldwell.*** *Journal of Applied Polymer Science,* v. 2, no. 5, Sept.-Oct. 1959, p. 198-202.

4814* Permeability of Various Polymers to 90% Hydrogen Peroxide. Theory and experimental work for the determination of the H_2O_2 permeability for various polymers at room and elevated temperatures. Compatibility tests indicate that many polymers decompose 90% H_2O_2 appreciably, while the effects of others are negligible. Activation energies for H_2O_2 permeation through plasticized PVC and polyvinylidine chloride were found to be 16 to 18 kcal./mole, respectively. ***Harry J. Dietrick and Wilkison W. Meeks.*** *Journal of Applied Polymer Science,* v. 2, no. 5, Sept.-Oct. 1959, p. 231-235.

4815 Intrinsic Viscosity-Molecular Weight Relationships for Isotactic and Atactic Polypropylene. I. High temperature light scattering studies of polypropylene in 1-chloronaph-

thalene at 125 C have provided weight average molecular weight-intrinsic viscosity relationships for atactic and isotactic polypropylene. ***J. B. Kinsinger and R. E. Hughes.*** *Journal of Physical Chemistry*, v. 63, Dec. 1959, p. 2002-2007.

4816* The Mechanism of Poly(vinyl Chloride) Stabilization by Barium, Cadmium, and Zinc Carboxylates. I. Infrared Studies. Deterioration in PVC is due primarily to zipperlike elimination of HCl from the polymer chain, with formation of colored and easily oxidizable polyenes. These studies show the presence of a band at 5.75 μ in the spectra of the films containing the 2-ethylhexanoates, which is absent from the spectra of the unmixed components. ***Alfred H. Frye and Raymond W. Horst.*** *Journal of Polymer Science*, v. 40, Nov. 1959, p. 419-431.

4817* Crystallization Behavior and Melting Properties of *m*-Phenylene Group Containing Polyesters. Polyesters containing *meta* phenylene groups can be crystallized. The entropies and enthalpies of melting of isomeric polyisophthalates and polyterephthalates were determined. Lower crystal melting points of the polyisophthalates are due mainly to a greater entropy of melting. ***A. Conix and R. Van Kerpel.*** *Journal of Polymer Science*, v. 40, Nov. 1959, p. 521-532.

4818* Light-Scattering Measurements on Selected Polyamides (Nylons). Studies on selected polyamides in a solvent system, 2,2,3,3,-tetrafluoropropanol with 0.1 *N* sodium trifluoroacetate, which meets the special requirements for polar molecules. ***Harold C. Beachell and Douglas W. Carlson.*** *Journal of Polymer Science*, v. 40, Nov. 1959, p. 543-549.

4819* New Catalyst for the Polymerization of Alkylene Oxides. A binary mixture of metal alkyl (diethyl zinc, diethyl cadmium, tri-ethyl aluminum, butyllithium) and alumina or silica-alumina was an excellent catalyst for the polymerization of alkylene oxides (ethylene oxide, propylene oxide, butadiene monoxide). The binary mixture gave polymers of much higher molecular weight in higher yield than alumina or silica-alumina alone. A reaction mechanism for this catalytic system is proposed. ***Junji Furukawa, Takeo Saegusa, Teiji Tsuruta, and Genjiro Kakogawa.*** *Makromolekulare Chemie*, v. 36, no. 1, Dec. 1959, p. 25-39.

4820* The Photo-Initiated Grafting of Vinyl Monomers to Cellulose and Other Polymers Using Anthraquinone Vat Dyes. Up to 300% of polyacrylonitrile and certain copolymers were successfully grafted onto cellulose using a photosensitizer and visible or near ultraviolet light. The sensitizers used are photo-tendering dyestuffs, in particular anthraquinone 2,7-disulfonic acid, sodium salt. ***N. Geacintov, V. Stannett, and E. W. Abrahamson.*** *Makromolekulare Chemie*, v. 36, no. 1, Dec. 1959, p. 52-66.

4821 Oriented Thermoplastic Sheet and Film. Increased mechanical strength and toughness are attributes of oriented thermoplastic sheet. Other properties such as resistance to crazing, aging, and weather may also be affected by orientation of some thermoplastics. ***C. P. Fortner and P. Dalton.*** *Materials in Design Engineering*, v. 50, Dec. 1959, p. 94-99.

4822 Film Strengths in Heat Processing. Simple method for estimating burst strength of heated food bags is outlined and data are given on three plastic films showing how their behavior differs under processing conditions. ***E. G. Davis, M. Karel, and B. E. Proctor.*** *Modern Packaging*, v. 33, no. 4, Dec. 1959, p. 135 + 4 pages.

4823 Chemical Structure and Stability Relationships in Polymers. A review of current knowledge of stability relationships between polymer structure and various environmental parameters, including thermal, ultra-violet, and nuclear radiant energy, O_2, water, and various climatic environments. ***B. G. Achhammer, Max Tryon, and G. M. Kline.*** *Modern Plastics*, v. 37, no. 4, Dec. 1959, p. 131 + 8 pages.

4824 Radiation-Induced Changes in the Structure of Polypropylene. Polypropylene undergoes both cross-linking and random main-chain fracture when exposed to high-energy radiation, the ratio of cross-linking to chain fracture varying with the dose received up to the gel point. An examination of the infrared absorption spectrum of the irradiated polymer has shown that, in addition, vinylidine unsaturation ($R.R'C{=}CH_2$) is formed in the ratio of one vinylidene double bond to each chain fracture. ***R. M. Black and B. J. Lyons.*** *Royal Society, Proceedings*, v. 253, ser. A, Dec. 15, 1959, p. 322-330.

4825* Polyethylene in Wire and Cable. Properties of a class of material prepared with low-density polyethylene by compounding with carbon black and a chemical cross-linking agent, subsequently crosslinking. A wide range of electrical and mechanical properties may be obtained by suitable compounding, varying the loading and the type of black. These properties may vary from a semi-conducting material to a low-loss insulator. All cured compounds are free from stress cracking and exhibit a minimum of plastic flow at elevated temperatures. ***B. B. S. T. Boonstra and Allen C. Bluestein.*** *Rubber Age*, v. 86, no. 3, Dec. 1959, p. 450-459.

4826* Use of Reground Glass-Filled Polystyrene. Reground glass-filled polystyrene blended with virgin material does not affect the strength of items molded from it. ***George R. Rugger.*** *SPE Journal*, v. 15, Dec. 1959, p. 1053-1054.

4827* The Dynamic Mechanical Properties of Epoxy Resins. There is a direct correlation between softening temperature by distortion or penetration, dilatometric glassy transition temperature of epoxy resins, and regions of major dynamic mechanical dispersion. ***D. H. Kaelble.*** *SPE Journal*, v. 15, Dec. 1959, p. 1071-1077.

4828* Thermal Degradation of Polymers at High Temperatures. Polystyrene was pyrolyzed in a vacuum and also in He at atmospheric pressure at 362 and at 850 C. Analysis of the volatile products indicates that higher temperatures and higher pressures cause a greater fragmentation of the volatile products. Samples of poly(vinylidene fluoride), polyacrylonitrile, and polytrivinylbenzene were pyrolyzed in a vacuum at temperatures from 350 to 800 C. ***Samuel L. Madorsky and Sidney Straus.*** *U. S. National Bureau of Standards, Journal of Research, Section A, Physics and Chemistry*, v. 63, no. 3, Nov.-Dec. 1959, p. 261-268.

See also: **4002** (inorganic polymerizations); 4156 (base materials for recording tape).

POLLUTION AND WASTES

4829* Diethylstilbestrol Absorption in Industry: A Test for Early Detection as an Aid in Prevention. ***R. M. Watrous and R. T. Olsen.*** *American Industrial Hygiene Association Journal*, v. 20, no. 6, Dec. 1959, p. 469-472.

4830* Planning for a Radiation Accident. Describes rational approaches to potential radiation accidents so that in the event of emergency a well organized plan can be immediately put into operation. ***Eugene L. Saenger.*** *American Industrial Hygiene Association Journal*, v. 20, no. 6, Dec. 1959, p. 482-487.

4831* Progress of the Automobile Industry in Regard to Automobile Exhaust and Air Pollution. ***James M. Chandler.*** *American Industrial Hygiene Association Journal*, v. 20, no. 6, Dec. 1959, p. 488-493.

4832* An Air Pollution Study of a Community Surrounding a Beryllium Plant. ***Victor H. Sussman, Jan Lieben, and John G. Cleland.*** *American Industrial Hygiene Association Journal*, v. 20, no. 6, Dec. 1959, p. 504-508.

4833* The Histopathological Effects of Ozone on Plant Foliage. Young plants of 32 species and varieties that were growing vigorously in the greenhouse were exposed to ozone at concentrations of 0.1 to 1.0 p.p.m. in a circulating stream of washed air. Plants are listed in descending order of susceptibility. Leaves become susceptible only as the stomata become functional. ***Myron C. Ledbetter, P. W. Zimmerman, and A. E. Hitchcock.*** *Boyce Thompson Institute, Contributions*, v. 20, no. 4, Oct.-Dec. 1959, p. 275-282.

4834* Stream Life Below Industrial Outfalls. ***William Marcus Ingram and W. W. Towne.*** *Public Health Reports*, v. 74, Dec. 1959, p. 1059-1070.

4835* On the Soil Chemistry of Cesium 137. Carrier-free Cs may be fixed in soils by way of a precipitation of the elements on surfaces of micaceous minerals. In the precipitation, the existing crystal lattice is altered or extended slightly so that the Cs is incorporated in a crystal structure. Also, even though this structure is continually dissolving and reforming, microscopically, the Cs cannot be released by exchange for H^+, Na^+, Ca^{++}, Mg^{++}, or Ba^{++}, because these ions do not fit into the crystal lattice. On the other hand, because of the microscopic dissolving and reforming, Cs is released to some extent by K^+, NH_4^+, and Cs^+, since such ions can substitute for Cs in the crystal. ***R. K. Schulz, Roy Overstreet, and I. Barshad.*** *Soil Science,* v. 89, no. 1, Jan. 1960, p. 16-27.

See also: **3826** (air sterilization filters); **3935** (waste treatment, HNO_3); **4307** (atmospheric pollution); **4848** (dust particle identification).

RUBBER AND ELASTOMERS

4836* Bibliography of Rubber Literature for 1952-54. References to all literature on the chemistry, engineering, and economics of rubber. ***M. E. Lerner, editor.*** 10th Ed. 793 pp. 1959. Division of Rubber Chemistry, American Chemical Society, Akron. (Z6297 Am35b Ref.)

4837 Introduction to Rubber Technology. A compilation of selected lectures that introduces new members of the rubber industry to the basic aspects of rubber technology. ***Maurice Morton, editor.*** 547 pp. 1959. Reinhold Publishing Corp., New York. (TS1890 Am35.6i)

4838* Oxidative Degradation of Polydiene Vulcanizates. Intermittent and continuous stress relaxation measurements were utilized to follow the oxidative degradation of vulcanizates of natural rubber, and of synthetically prepared polybutadienes. Vulcanizates were prepared by exposing samples to high-energy electrons. ***A. V. Tobolsky and A. Mercurio.*** *Journal of Applied Polymer Science,* v. 2, no. 5, Sept.-Oct. 1950, p. 186-188.

4839* The Mechanism of Tire Wear. The simple theory on the wear of slipping wheels described accounts semiquantitatively for observed effects and, in addition, draws attention to the hitherto unsuspected role of hysteresis in the wear mechanism. Effect of hysteresis was verified experimentally for small, solid wheels and it is shown that differences in elastic constants can outweigh differences in abrasion resistance. Mechanical properties of tires are dominated by the pneumatic casing, the tread making a minor contribution to its over-all behavior. (*In English and French.*) Le mecanisme de l'usure du pneu. ***A. Schallamach.*** *Revue Générale du Caoutchouc,* v. 36, Oct. 1959, p. 1479-1485.

4840* Behaviour of Supersonic Plane Tires at High Temperatures. A procedure is given for testing tires by using an oven with a range of 50 to 250 C. After cooling the tire is subjected to simulated landings. (*In English and French.*) Tenue des pneumatiques d'avions supersoniques aux temperatures elevees. ***Ch. Birot.*** *Revue Générale du Caoutchouc,* v. 36, Oct. 1959, p. 1539-1542.

4841* Making More Flexible Urethane Elastomers With Castor Polyols. A series of urethane elastomers based on three prepolymers prepared from DB Oil and two alternate castor polyols were studied. Tailor-made physical properties can be built into these elastomers by proper selection of the prepolymer and the curing castor polyol. The wide range of physical properties obtained using castor oil as a relatively inexpensive source of the polyols should insure their use in numerous commercial applications. ***T. C. Patton, A. Ehrlich, and M. K. Smith.*** *Rubber Age,* v. 86, no. 4, Jan. 1960, p. 639-644.

4842* Planned Experiments in the Rubber Industry. Comparison made of the concept of planned experiments and the more familiar classical or Edisonian approach commonly employed to solve research and development problems in the rubber and associated industries. ***J. A. Sigmann.*** *Rubber World,* v. 141, no. 4, Jan. 1960, p. 515-519.

See also: **3990** (zinc oxide in rubber).

SPACE HEATING AND CONDITIONING

4843 Matching Home Air Conditioning Energy Requirements and the Weather. One community's average gas consumption was used as the base load for all air conditioning customers; the Degree Day Deficiency relationship which avoids peculiarities of the owner and relies on the practice of the average customer was applied; results correlated residential air conditioning energy requirements with atmospheric conditions. ***R. B. Joplin and E. H. Muehlhause.*** *ASHRAE Journal,* v. 2, Jan. 1960, p. 70-72.

4844 What Future for Solar Heating? *R. C. Jordan.* *ASHRAE Journal,* v. 2, Jan. 1960, p. 74-77.

4845* Coil Performance Solutions Without Trial and Error. Forced circulation air cooling, heating, and dehumidifying coil performance calculations, when based on the effectiveness concept, avoids cumbersome trial and error computations association with the long mean temperature difference method. ***Tamami Kusuda.*** *Air Conditioning, Heating and Ventilating,* v. 57, Jan. 1960, p. 73-80.

4846* Better Air for Industry. I. Industrial dust collection and air filtration systems emphasizing operation, application, and effectiveness. ***Richard V. Sloan.*** *Air Engineering,* v. 1, no. 2, Dec. 1959, p. 41 + 3 pages.

4847* Gas vs. Electricity as a Fuel. I. Study of two new buildings. *Air Engineering,* v. 2, no. 1, Jan. 1960, p. 20 + 3 pages.

4848* How Dust Particles Are Identified. Pollutant particle identification can often pin point the source of the pollutant. ***M. A. Salzenstein.*** *Air Engineering,* v. 2, no. 1, Jan. 1960, p. 31-34.

4849* Better Air for Industry. II. Merits and shortcomings of air cleaning equipment; precipitators, various types of fabric collectors, and bag houses. ***Richard V. Sloan.*** *Air Engineering,* v. 2, no. 1, Jan. 1960, p. 37-38.

4850* A Contribution to the Study of Lighting Problems in the Foundry. (*In German.*) Ein Beitrag zur Beleuchtung von Giessereien. ***C. Saatmann.*** *Giesserei,* v. 46, no. 26, Dec. 17, 1959, p. 984-988.

4851* Planned Home Lighting. Describes lighting of first prize-winning home in Pacific Northwest Regional Contest of the I. E. S. ***Al Natalie.*** *Illuminating Engineering,* v. 54, Dec. 1959, p. 729-731.

TEXTILES, FIBERS, LEATHER, AND PAPER

4852* The Mechanical Properties of Collagen and Leather Fibres. Compares the strength and breaking extension of raw and tanned fibers. Includes a study of the effect of different test conditions on the strength and breaking extension of raw fibers, and an investigation of the influence of different kinds of straight vegetable and chrome tannage upon fiber strength and extensibility. ***F. R. Morgan.*** *American Leather Chemists Association, Journal,* v. 55, Jan. 1960, p. 4-23.

4853* New Chemical Treatment Curbs Shrink and Swell of Walnut Gunstocks. Reduces shrinkage and swelling to less than thermal expansion of most plastics. Practically eliminates splits, checks, and other seasoning degrade. Reduces kiln time by about two weeks. Advantages for the rifleman-dimensional stability plus warmth and beauty of wood. ***H. L. Mitchell and H. E. Wahlgren.*** *Forest Products Journal,* v. 9, Dec. 1959, p. 437-441.

4854* Relation Between Physical and Chemical Properties of Wood and Adhesion. Wettability, pH, and specific gravity are closely related to glue-bond quality. Specific gravity is generally more important, and pH and wettability less with resorcinol-phenol bonds than with urea bonds. In most respects, shear ratio, shear strength, and percentage of wood failure

agree as indicators of glue-bond quality. ***H. A. Freeman.*** *Forest Products Journal,* v. 9, Dec. 1959, p. 451-458.

4855 Handbook and Directory of the Forest Industries 1959, 40th Annual Edition. 540 pp. 1958. Miller Freeman Publications, San Francisco. (T13 F76Lt)

4856* Oils, Waxes, and Their Derivatives in Leather Finishing. ***Bernard A. Roll.*** *Leather Manufacturer,* v. 77, Feb. 1960, p. 25 + 5 pages.

4857* Needed: A Planter With Built-In Power. Experience with other mechanisms suggests that a 10-horsepower engine could be mounted directly to a planter vehicle for needed power. With such a self-propelled unit, planting could be done by one man who would ride on the vehicle, guide it, and feed seedlings into the planter mechanism. A suitable hole in the ground could be made for the planting of each seedling, using a modification of a trenching device or a rotating or a drilling type unit which would dig a hole six inches across and 18 inches deep. The soil could be replaced in the hole mechanically and tamped following the placement of the seedling in the hole at the proper depth for planting. A method for setting desired spacing of trees could be built into the planter mechanism, and some method for applying fertilizer or water or both could be developed and made operable on the planter. ***William C. Finley.*** *Pulp and Paper,* v. 34, Jan. 1960, p. 99.

4858* Beating, Fibre Length Distribution and Tensile Strength. ***Morris W. Kane.*** *Pulp and Paper Magazine of Canada,* v. 60, Dec. 1959, p. T359-T365.

4859* Scanning Electron Microscopy in Pulp and Paper Research. ***K. C. A. Smith.*** *Pulp and Paper Magazine of Canada,* v. 60, Dec. 1959, p. T366-T371.

4860* Recent Trends in Leather Research in the United States. ***Henry B. Merrill.*** *Society of Leather Trades' Chemists, Journal,* v. 43, Dec. 1959, p. 431-434.

4861* The Impact of Research on the Paper and Pulp Industry. ***Walton R. Smith.*** *Southern Pulp Manufacturer,* v. 23, Jan. 11, 1960, p. 84-86.

4862* Laminar Flow of Dilute Fibre Suspension. Flow is considered on the basis of observed characteristics. It is assumed that there is a separation into two regions, one moving as a solid body and containing all of the fiber, and the other a thin film of liquid. Flow in pipes is considered in detail, particularly the consequences of this type of motion on the friction characteristics. Flow between rotating concentric cylinders is also considered, and it is shown how this type may be used to predict the friction properties of pipes. ***W. D. Baines.*** *Svensk Paperstidning,* v. 62, no. 22, Nov. 30, 1959, p. 823-828.

4863* Printing With the Fiber Reactives. The most recent color development of particular interest to cotton printers is the fiber-reactive group of dyes, which exemplify a new concept in the attachment of color to cellulose by direct chemical combination rather than by mechanical retention. The fiber reactives are also uique because their high brillance is accompanied by wet fastness. These two properties are normally not associated together. *Textile Industries,* v. 124, Jan. 1960, p. 74-80.

4864* The Development of Washable Non-Iron Effects in Pure Wool Fabrics. The use of reducing agents for setting wool has been extended to give washable non-iron effects on pure wool fabrics. Initially, this was accomplished by applying the Si-Ro-Set proces to garments made from shrinkproofed wool. This led to flat setting of fabrics in the mill by applying a dilute solution of a reducing agent to the fabric followed by immediate steaming on a blowing machine. ***A. J. Farnworth, M. Lipson, and J. R. McPhee.*** *Textile Research Journal,* v. 30, Jan. 1960, p. 11-22.

4865* The Action of Nitric and Hydrochloric Acids on Wool With Particular Reference to Supercontraction of the Fibers. The kinetics of supercontraction are discussed in terms of chemical and configurational changes in the fibers. ***W. G. Crewther and L. M. Dowling.*** *Textile Research Journal,* v. 30, Jan. 1960, p. 23-26.

4866* The Relation of Wet and Dry Crease Recovery to Wash-Wear Behavior. Covalent cross-linking of a dry fiber enhances both wet and dry recovery, and the ratio of the two values is believed to depend on the relative accessibilities of the fiber to water and to the cross-linking reagent. Water-sensitive links between cellulose chains can give high dry and low wet crease recovery. Cross-linking reactions carried out when the fiber is wet and swollen lead to good wet crease recovery, although the dry recovery is not improved. To achieve good tumble-dry- wash-wear behavior, both wet and dry crease recovery must be increased. In line- and drip-drying, the wet crease recovery has more significance than the dry. ***Richard Steele.*** *Textile Research Journal,* v. 30, Jan. 1960, p. 37-46.

4867* The Physical State of Direct Dyes in Viscose and Its Influence on Lightfastness. I. A Method of Examining the Physical State of Direct Dyes in Viscose. Unaggregated dye exhibited considerably poorer lightfastness on rayon than the one which aggregated in viscose. ***Leonard Weissbein and Glenn E. Coven.*** *Textile Research Journal,* v. 30, Jan. 1960, p. 58-62.

See also: **3798** (plant gums and mucilages); **4110** (rug-backing compounds).

WELDING AND JOINING

4868* Contraction and Internal Stresses in Bonded Joints. The shrinkage and post-shrinkage which occur in adhesives, which are of high polymer materials, set up internal stresses in the bonds. (*In German.*) Schwindung und Eigenspannungen in Klebverbindungen. ***W. Späth.*** *Aluminium (Dusseldorf),* v. 35, Oct. 1959, p. 576-582.

4869 Adhesive Bonding Plus Riveting Builds Leakproof Tanks. Describes manufacture of wing fuel tanks for Convair 880 and 600 jet transports. *American Machinist,* v. 103, Dec. 28, 1959, p. 88-89.

4870 Electric Welding. Will It Revolutionise the Methods of Boiler-Making? An interesting historical accounting of welding forty years ago. *British Welding Journal,* v. 6, Dec. 1959, p. 562-563.

4871 Effect of Wire Diameter on Metal Transfer in the Aluminium Self-Adjusting Arc. ***A. A. Smith and J. G. Poley.*** *British Welding Journal,* v. 6, Dec. 1959, p. 565-568.

4872 Fatigue Tests of Plain Plate Specimens and Transverse Butt Welds in Mild Steel. First interim report of an investigation into the fatigue strength of butt welds in mild steel plate. ***R. P. Newman and T. R. Gurney.*** *British Welding Journal,* v. 6, Dec. 1959, p. 569-594.

4873 Raising of Studs on Metal Surfaces. A process by which molten metal can be expelled from a spot weld and cast to form a stud, welded to the parent metal. Cylindrical studs have been formed in a range of ferrous and nonferrous materials. ***E. J. French.*** *British Welding Journal,* v. 6, Dec. 1959, p. 595-598.

4874 Better Welding Techniques. Four improved methods are noted. *Engineering,* v. 188, Nov. 27, 1959, p. 562-563.

4875* Synthetic Adhesives—an Engineering and Technology Report. Amazing new materials that hold as never before. A practical guide on how and when to use. ***R. K. Humke.*** *Factory,* v. 118, Jan. 1960, p. 51-59.

4876 Automatic Brazing Machine in Continuous Line for Assembling Heat Exchangers. ***Norman L. Boisvert.*** *Industrial Heating,* v. 26, Dec. 1959, p. 2442 + 3 pages.

4877 Double Fatigue Life for Threaded Fasteners. Details of a new thread form. *Machine Design,* v. 31, Dec. 24, 1959, p. 24-26.

4878 High Frequency—What It Means to Welding Design. Operate an electric welder at the higher frequencies—say, 450 kc—and you can get stronger welds in a wider variety of materials. But this high-frequency current works differently than the 60 cycles in conventional welding. Here's what h-f welding can do for you. ***Richard J. Allen.*** *Product Engineering*, v. 31, no. 1, Jan. 4, 1960, p. 42-44.

4879* Principles and Developments of the Quality Coefficient for Welded Seams in Pressure Vessels. Discusses quality coefficients, compares those used in American, British, and German strength calculations, and future applications. (*In German.*) Zur Entwicklung und Systematik des Schweissnahtgütefaktors im Druckbehälterbau. ***E. Rubo.*** *Schweissen und Schneiden*, v. 11, Nov. 1959, p. 409-415.

4880* Welding of Ferritic Annealed Nodular Cast-Iron. Plasticity, TIG-welding, arc-welding, gas-welding, filler metals, welding technology, and heat treatment. (*In German.*) Das Schweissen von ferritisch geglühtem Gusseisen mit Kugelgraphit. ***W. Zitzelsberger.*** *Schweissen und Schneiden*, v. 11, Nov. 1959, p. 416 + 10 pages.

4881* Welding Developments. New Tools for Production. A summary of recent developments in the field of pressure and arc welding designed to give an up-to-date review of the subject. ***J. Frederick Parr.*** *Tool Engineer*, v. 44, no. 1, Jan. 1960, p. 115-124.

4882 Submerged-Arc Welding of Low Alloy Steel Sheet. II. Development of Production Welding Techniques. Discussion in relation to the manufacture of thin-walled tubes. ***C. A. Terry and A. B. Tinsley.*** *Welding and Metal Fabrication*, v. 28, Jan. 1960, p. 9-15.

4883* What Management Should Know About Automatic Welding Machinery. *Welding Design & Fabrication* editors interviewed both users and manufacturers of automatic welding machinery and asked them this question: "What should management know about automatic welding machines?" *Welding Design & Fabrication*, v. 33, Jan. 1960, p. 31.

4884* 6 Questions on Automatic Welding Machinery. Management will know all they need to about the automatic welding machines their companies are buying if they have their welding supervisors answer these questions. *Welding Design & Fabrication*, v. 33, Jan. 1960, p. 34 + 2 pages.

4885* New Automatic Process Speeds Vertical Welding of Heavy Plate. New automatic machine permits continuous, one-pass welding of plate or forgings from 1½ to more than 10 inches thick which can be welded in the vertical position. *Welding Design & Fabrication*, v. 33, Jan. 1960, p. 36 + 2 pages.

4886* New Gantry Welder Speeds Girth Welding of Missile Shells. Reynold's girth welder used to be tied up for hours waiting for shells to be assembled. There's no waiting now with their new gantry welders and 180-ft-long turning roll lines. *Welding Design & Fabrication*, v. 33, Jan. 1960, p. 45 + 1 page.

4887* Redesign for Welding Cuts Lathe Cost 35%. Oliver Machinery Co. redesigned a 50-year-old cast iron lathe for welded construction. The new lathe sells for 35% less than the cast iron one. *Welding Design & Fabrication*, v. 33, Jan. 1960, p. 48-49.

4888* Alloy Steel Pressure Vessels Are Proofed at 155,000 psi. Hughes has kept rejects due to welding under 1% and rejects due to other processes low by close processing controls and critical inspection and test. ***P. C. Simmons and William Sponheimer.*** *Welding Design & Fabrication*, v. 33, Jan. 1960, p. 52 + 2 pages.

4889* Design for Cold-Welding Makes Vacuum-Tight Copper Joints. An engineered cold-welding line with vacuum drying furnaces, dry-air welding atmosphere and clean parts makes possible top-quality, high-volume production of Cu transistor components. *Welding Design & Fabrication*, v. 33, Jan. 1960, p. 54-55.

4890* The Welding of Ductile Iron. WRC interpretive report indicates that strong, ductile joints are attainable in ductile Fe. However, in most cases, long postweld heat treatments may be required to attain desired properties. ***G. R. Pease.*** *Welding Journal*, v. 39, Jan. 1960, p. 1s-9s.

4891* Plastic Properties of Aluminum-Magnesium Weldments. Investigates the effect of welding variables on the relative toughness, elongation, hardness strain and peak temperature distributions. ***Sheldon S. White, Ralph E. Manchester, William C. Moffatt, and Clyde M. Adams, Jr.*** *Welding Journal*, v. 39, Jan. 1960, p. 10s-19s.

4892* Automatic Welding Procedures in the Fabrication of Plate Girders. Advanced techniques for the application of the submerged-arc and magnetic-flux gas-shielded processes. ***C. A. Zwissler.*** *Welding Journal*, v. 39, Jan. 1960, p. 13-18.

4893* Butt Welding Steel Sheet by the Foil-Seam Process. Accomplished by introducing a thin, narrow strip of mild steel on both sides of the abutted workpiece edges and passing this "sandwich" between roller electrodes. ***L. W. Mecklenborg.*** *Welding Journal*, v. 39, Jan. 1960, p. 19-28.

4894* Correlation of Toughness Between H-Plate and Charpy-Impact Tests. Objectives of laboratory tests are to evaluate the differences that exist between three armor-composition types and to determine whether effects of the differences as indicated by H-plate performance can be predicted by composite Charpy tests. ***W. P. Hatch, Jr.*** *Welding Journal*, v. 39, Jan. 1960, p. 20s-30s.

4895* Thermal Fatigue and High-Temperature Brazements. ***Robert L. Peaslee.*** *Welding Journal*, v. 39, Jan. 1960, p. 29-33.

4896* Impact Characteristics of Heat-Affected Zones in Mn-Mo Armor Steels. Four armor steels are studied to determine the effects of weld thermal cycles on the notch toughness of the partially austenitized regions of the weld heat-affected zones. ***E. F. Nippes, W. F. Savage, and J. M. Paez.*** *Welding Journal*, v. 39, Jan. 1960, p. 31s-39s.

4897* With Submerged-Arc Welding . . . 2+4=8. Use of 2 submerged-arc welding heads and welding composition to produce longer part life and finish the job up to eight times faster than the manual covered-electrode process used previously. ***O. W. Stauffer and G. E. Motzenbecker.*** *Welding Journal*, v. 39, Jan. 1960, p. 39.

4898* Huge Weldments Are Critical in Structure of New Pittsburgh Auditorium. ***Charles W. Lytton.*** *Welding Journal*, v. 39, Jan. 1960, p. 40-42.

4899* An Investigation of Welded Crack Arresters. Laboratory studies undertaken to investigate the possibility of halting a propagating brittle crack by directing it into a strake of tough steel. ***R. J. Mosborg.*** *Welding Journal*, v. 39, Jan. 1960, p. 40s-48s.

4900* Weldability Tests of Chrome-Nickel Steels and Electrodes. Concerns weldability of austenitic chrome-nickel. (*In Czech.*) Zkoušky svařitelnosti austenitických chromoniklových ocelí a elektrod. ***Josef Němec.*** *Zváranie*, v. 8, no. 11, Nov. 1959, p. 321-328.

See also: **4078** (hot-melt adhesives); **4105** PVAC emulsion adhesives); **4111** (polyethylene glycol fluxes); **4636** (weld inspection).

MISCELLANEOUS

4901* Some Validity Criteria for Statistical Inferences. Ways in which existing statistical theories specify the degree of uncertainty of an inference. ***Robert J. Buehler.*** *Annals of Mathematical Statistics*, v. 30, no. 4, Dec. 1959, p. 845-863.

4902* Conditional Confidence Level Properties. ***David L. Wallace.*** *Annals of Mathematical Statistics,* v. 30, no. 4, Dec. 1959, p. 864-876.

4903* Bayes Acceptance Sampling Procedures for Large Lots. Purpose is to find explicit asymptotic characterizations for large N of the decision procedures and sample sizes which are optimal in the Bayes sense for various classes of *a priori* probability distributions defined over the values of the parameter λ. ***D. Guthrie, Jr. and M. V. Johns, Jr.*** *Annals of Mathematical Statistics,* v. 30, no. 4, Dec. 1959, p. 896-925.

4904* Properties of Model II—Type Analysis of Variance Tests, A: Optimum Nature of the *F*-Test for Model II in the Balanced Case. ***Leon H. Herbach.*** *Annals of Mathematical Statistics,* v. 30, no. 4, Dec. 1959, p. 939-959.

4905* The Use of Sample Quasi-Ranges in Estimating Population Standard Deviation. The use of sample quasi-ranges in estimating the standard deviation of normal, rectangular, and exponential populations is discussed. ***H. Leon Harter.*** *Annals of Mathematical Statistics,* v. 30, no. 4, Dec. 1959, p. 980-999.

4906* Some Convergence Theorems for Stationary Stochastic Processes. ***T. Kawata.*** *Annals of Mathematical Statistics,* v. 30, no. 4, Dec. 1959, p. 1192-1214.

4907* The Capacity of a Class of Channels. Shannon's basic theorem on the capacity of a channel is generalized to the case of a class of memoryless channels. A generalized capacity is defined and is shown to be the supremum of attainable transmission rates when the coding and decoding procedure must be satisfactory for every channel in the class. ***David Blackwell, Leo Breiman, and A. J. Thomasian.*** *Annals of Mathematical Statistics,* v. 30, no. 4, Dec. 1959, p. 1229-1241.

4908* Mechanical Handling of Motor Bodies in a New Painting and Assembly Plant. Built at the cost of £ 10m, the new Ford paint, trim and assembly building at Dagenham, England, is equipped with a selective type of conveyor system. Like the new press shop which serves it, the building is, in effect, designed around flow line handling equipment. *Automation Progress,* v. 4, Nov. 1959, p. 366-371.

4909* The American Steel Strike and Automation. The present crisis in the American economy is based on a struggle for the fruits of automation and could easily be repeated in Europe with disastrous consequences. Such a crisis need never occur if the proper economic climate is created for the further development of automation. ***W. A. Meseke.*** *Automation Progress,* v. 4, Nov. 1959, p. 376-377.

4910 The Finance Pattern Data for a Much-Needed Monetary Debate. Discusses Britain's Radcliffe report to the government on the English monetary system, and its implications concerning U. S. monetary policy. *Business Week,* no. 1580, Dec. 12, 1959, p. 65-66.

4911* Education—Is Industry Pulling Its Weight? Survey of two dozen chemical process firms show variations in approach to educational aid. The conclusion is reached that a great deal more financial aid will have to be given to colleges by industry in order to fill future needs of trained personnel in industry. *Canadian Chemical Processing,* v. 43, Nov. 1959, p. 30 + 2 pages.

4912 Peripheral Professional Problems of Engineering Management. The manager of engineering has the responsibility for assuring optimum utilization of all facilities. The concept of peripheral professional problems points out the many areas of interest to which the manager's attention must be directed. ***C. F. Savage.*** *Electrical Engineering,* v. 78, Dec. 1959, p. 1160-1163.

4913* Recent Production Developments in the Soviet Union. First part of observations by the author, who is director of the Production Engineering Research Association of Great Britain. ***D. F. Galloway.*** *Engineer,* v. 208, Dec. 18, 1959, p. 811-813.

4914* AMA Lays It on the Line. Brief resumé of opinions expressed at AMA's first course in Personnel Management in New York. The country's top personnel managers blast practices in their own field, urge closer cooperation in the plant management. ***Lawrence F. Mihlon.*** *Factory,* v. 118, Jan. 1960, p. 46-50.

4915 Topology and the Solution of Linear Systems. The concepts of linear graph theory are applied to the study of feedback systems. ***Robert B. Ash.*** *Franklin Institute, Journal,* v. 268, no. 6, Dec. 1959, p. 453-463.

4916* Effects of Radiation on Performance. Discusses experimental studies relating to the effect of various types of radiation on learning, activity and manipulation, conditioning, and discrimination. The difficulty of inferring an effect in man, and the confounding due to uncontrolled variables are highlighted. ***Paul Tobias.*** *Human Factors,* v. 1, no. 4, Nov. 1959, p. 8-15.

4917* Human Factors in Man-Machine Systems. Analyzes field of human factors in effort to discover its scope and organization. Three orthogonal partitions of the field serve to define eight mutually exclusive, jointly exhaustive, and interdependent sectors. These are considered separately. ***Harold E. Bamford, Jr.*** *Human Factors,* v. 1, no. 4, Nov. 1959, p. 55-59.

4918 Chemical Aspects of Fire Extinguishment. Concepts of fire and fire extinguishment must be revamped because recent findings add a fourth dimension to the fire triangle. ***A. B. Guise.*** *Industrial and Engineering Chemistry,* v. 51, Nov. 1959, p. 73A-75A.

4919* Personnel Factors in Plant Relocation. ***Robert D. Courtright.*** *Industrial Development,* v. 128, no. 12, Nov. 1959, p. 61-64.

4920* Engineering Education at the Technical Universities in Western Germany. Report submitted to the Lord President of Great Britain of the Council and to the Secretary of State for Foreign Affairs at whose suggestion and under whose auspices the team visited Germany in order to attempt to establish a comparison between the academic levels achieved in higher engineering education in Great Britain and in Western Germany. ***D. B. Welbourn, D. B. Spalding, and G. L. Ashdown.*** *Institution of Electrical Engineers, Proceedings,* v. 106, pt. A, no. 30, Dec. 1959, p. 409-419.

4921* A Method of Solution of Linear Partial Differential Equations of the Second Order With Function Coefficients. ***Moritsune Uchiyama.*** *Japan Academy, Proceedings,* v. 35, no. 7, July 1959, p. 316-320.

4922* Cauchy Integral on Riemann Surfaces. ***Kôichi Tarumoto.*** *Japan Academy, Proceedings,* v. 35, no. 7, July 1959, p. 349-353.

4923* Normal Operators in Hilbert Spaces and Their Applications. ***Sakuji Inoue.*** *Japan Academy, Proceedings,* v. 35, no. 7, July 1959, p. 359-364.

4924* On Singular Perturbation of Linear Partial Differential Equations With Constant Coefficients. I. ***Mitio Nagumo.*** *Japan Academy, Proceedings,* v. 35, no. 8, Oct. 1959, p. 449-454.

4925* A Unique Continuation Theorem of a Parabolic Differential Equation. ***Taira Shirota.*** *Japan Academy, Proceedings,* v. 35, no. 8, Oct. 1959, p. 455-460.

4926 Teaching Machines. Teaching machines are proving exceptionally successful wherever they are used. ***Jesse H. Day.*** *Journal of Chemical Education,* v. 36, Dec. 1959, p. 591-595.

4927* National Science Foundation Fellowships Programs. Support of Training in Engineering Sciences. Explains the purpose and the administration of the fellowship program, with tables of subject and geographical distribution of those in the program. ***Thomas D. Fontaine.*** *Journal of Engineering Education,* v. 50, no. 3, Dec. 1959, p. 216-229.

4928* Success Probability and Choice Behavior. Effect of varying a person's subjective probability of attaining a goal in a choice situation involving different goal objects. ***N. T. Feather.*** *Journal of Experimental Psychology,* v. 58, no. 4, Oct. 1959, p. 257-266.

4929* Stimulus Correlates for the Judged Illumination of a Surface. ***Jacob Beck.*** *Journal of Experimental Psychology,* v. 58, no. 4, Oct. 1959, p. 267-274.

4930* Time Estimates as Affected by Motivational Level, Goal Distance, and Rate of Progress. Tests the following hypotheses: (a) For Ss not motivated to reach the end of a task, perceived duration is unrelated either to rate of locomotion or to distance from the end of the task, and (b) for Ss motivated to reach the end of the task, perceived duration is inversely related to rate of progress and distance from the goal. ***Robert D. Meade.*** *Journal of Experimental Psychology,* v. 58, no. 4, Oct. 1959, p. 275-279.

4931* Stimulus Similarity and Task Familiarity as Determinants of Expectancy Generalization. ***Douglas Heath.*** *Journal of Experimental Psychology,* v. 58, no. 4, Oct. 1959, p. 289-294.

4932* Frustration Stimuli in Discrimination. Evaluates the role of assumed frustration stimuli in discrimination learning. ***D. W. Tyler, Melvin H. Marx, and George Collier.*** *Journal of Experimental Psychology,* v. 58, no. 4, Oct. 1959, p. 295-301.

4933* The Effect of "Social" Discriminative Cues on Probability Learning. The effect upon verbal conditioning of the introduction of a probabilistic cue with a social connotation was studied by means of a fractorial design comprising three values of event probability and five values of cue reliability. ***Edith D. Neimark and Seymour Rosenberg.*** *Journal of Experimental Psychology,* v. 58, no. 4, Oct. 1959, p. 302-311.

4934* The Engineering of Managers. As business grows more complex, more technical, more interrelated and interdependent, its management and direction will require technically oriented executives. Logically, these will come in large part from the ranks of engineers. ***A. L. Solliday.*** *Journal of Petroleum Technology,* v. 11, Dec. 1959, p. 11-13.

4935 Labor-Management Relations. The critical problems involved in employee-employer relations are the major concerns of this new book. It also presents methods for their solution, and new techniques for management administration and policy in both union and non-union operations. The principles outlined apply to blue collar, white collar and professional employees. ***Charles Wiedemann.*** 142 pp. 1959. Reinhold Publishing Corp., New York. (HD6961 W63L)

4936 Personnel Policies—Framework for Management Decisions. Written personnel policies can help an organization to achieve consistency and fairness in its treatment of its employees and can make possible the economy of operations that results when the broadest possible range of decisions are made routine and easily delegated. ***Ernest C. Miller.*** *Management Review,* v. 49, Jan. 1960, p. 20-26.

4937* The Splitting of Some Combined Abel Groups. Splitting problems are discussed, including on the one hand, factor groups of p-full groups, and on the other hand, the ones which include factor groups which are completely separable; the E. S. Liapin criterion is also discussed. (*In Russian.*) O rasshcheplenii nekotorykh smeshannykh abelevykh grupp. ***V. S. Zhuravskiĭ.*** *Matematicheskiĭ Sbornik,* v. 48, no. 4, Aug. 1959, p. 499-508.

4938* An Iterative Approximation for Finding the *N*-Th Root of a Number. ***H. W. Gould.*** *Mathematics Magazine,* v. 33, no. 2, Nov.-Dec. 1959, p. 61-69.

4939* Material Handling—Key to Higher Productivity. How a steady, uninterrupted flow of materials to and from each workman will, on an average, raise productivity by at least 15%, using existing productive machine equipment. ***Jack Hollingum.*** *Metalworking Production,* v. 103, no. 46, Nov. 13, 1959, p. 1815-1832.

4940* Lower Bounds for Risk Functions in Estimation. ***M. M. Rao.*** *National Academy of Sciences, Proceedings,* v. 45, Dec. 1959, p. 1768-1771.

4941* Good Planning + People = Profits. Some ideas that should be weighed for a successful management planning formula. ***Stanley R. Rinehart.*** *National Lithographer,* v. 66, Dec. 1959, p. 40 + 4 pages.

4942 Institute of Personnel Management. A brief accounting of the papers presented at Harrogate. *Nature,* v. 184, Nov. 21, 1959, p. 1614-1616.

4943 Chromatic and Short Term Dark Adaptation of the Human Electroretinogram. The human electroretinogram was elicited by test flashes which followed 2.5 sec after the termination of a colored adaptation. Typically, the electroretinogram consisted of a negative wave followed by a double positive deflection. The negative wave gave evidence of mixed photopic-scotopic activity. The first positive wave showed high red photopic sensitivity when elicited by long wavelength test flashes, and scotopic sensitivity when elicited by short wavelength test flashes. The second positive wave was scotopic. ***John C. Armington.*** *Optical Society of America, Journal,* v. 49, Dec. 1959, p. 1169-1175.

4944* A Minimal Boundary for Function Algebras. ***Errett Bishop.*** *Pacific Journal of Mathematics,* v. 9, no. 3, Fall 1959, p. 629-642.

4945* The Topology of Almost Uniform Convergence. ***John W. Brace.*** *Pacific Journal of Mathematics,* v. 9, no. 3, Fall 1959, p. 643-652.

4946* Chainable Continua and Indecomposability. Includes a study of continua which are both linearly and circularly chainable. ***C. E. Burgess.*** *Pacific Journal of Mathematics,* v. 9, no. 3, Fall 1959, p. 653-659.

4947* Ranges and Inverses of Perturbed Linear Operators. Investigates some invariant properties of the range and inverse of T when T is perturbed by a bounded linear operator A. ***Seymour Goldberg.*** *Pacific Journal of Mathematics,* v. 9, no. 3, Fall 1959, p. 701-706.

4948* On Functions Representable as a Difference of Convex Functions. ***Philip Hartman.*** *Pacific Journal of Mathematics,* v. 9, no. 3, Fall 1959, p. 707-713.

4949* Arcs in Partially Ordered Spaces. Presents a theorem on the existence of arcs in partially ordered spaces, and several applications to topological semigroups. The hypotheses are motivated by the structure of the partially ordered set of principal ideals of a compact connected topological semigroup with unit. ***R. J. Koch.*** *Pacific Journal of Mathematics,* v. 9, no. 3, Fall 1959, p. 723-728.

4950* Chains of Infinite Order and Their Application to Learning Theory. Studies the asymptotic behavior of a large class of stochastic processes which have been used as models of learning experiments, using a theory of so-called "chains of infinite order". ***John Lamperti and Patrick Suppes.*** *Pacific Journal of Mathematics,* v. 9, no. 3, Fall 1959, p. 739-754.

4951* Classes of Minimal and Representative Domains and Their Kernel Functions. Discusses "minimal domains" and "representative domains" with respect to certain subclasses of analytic functions, and deduces solutions to some extreme problems. ***Michael Maschler.*** *Pacific Journal of Mathematics,* v. 9, no. 3, Fall 1959, p. 763-782.

4952* Recurrent Markov Chains. ***S. Orey.*** *Pacific Journal of Mathematics,* v. 9, no. 3, Fall 1959, p. 805-827.

4953* On Nonlinear Positive Operators. Applies the well known Schauder fixed point theorem, in its general form due to Tychonov, to the situation of nonlinear (or rather, not

necessary linear) maps defined on (or on a subset of) the "positive" cone in a partially ordered locally convex linear space. ***H. H. Schaefer.*** *Pacific Journal of Mathematics*, v. 9, no. 3, Fall 1959, p. 847-860.

4954* Some Connections Between Continued Fractions and Convex Sets. Develops certain connections between the continued fraction solutions and the convex set solutions to some of the moment problems. ***Robert Seall and Marion Wetzel.*** *Pacific Journal of Mathematics*, v. 9, no. 3, Fall 1959, p. 861-873.

4955* Variations on a Theme of Chevalley. Uses the methods of C. Chevalley to construct some simple groups and to gain for them the structural theorems of Chevalley's "Sur Certains Groupes Simples". ***Robert Steinberg.*** *Pacific Journal of Mathematics*, v. 9, no. 3, Fall 1959, p. 875-891.

4956* Orderings of the Successive Overrelaxation Scheme. ***Richard S. Varga.*** *Pacific Journal of Mathematics*, v. 9, no. 3, Fall 1959, p. 925-939.

4957* On Weak Dimension of Algebras. Characterizes algebras whose weak dimension is zero, i.e., algebras A which are flat A^e-modules. ***Orlando E. Villamayor.*** *Pacific Journal of Mathematics*, v. 9, no. 3, Fall 1959, p. 941-951.

4958* Human Relations. A chapter in the "How to Be a Manager" series explaining the problems in getting along with people as you go ahead in business. ***William E. Bright, Jr.*** *Petroleum Engineer*, v. 31, Dec. 1959, p. E-9 + 3 pages.

4959* Plant Modernization to Mechanize Material Handling. Numerous alterations and improvements can be made to older industrial buildings to permit more efficient material flow, and subsequently, increase plant efficiency. ***A. T. Gaudreau.*** *Plant*, v. 20, Dec. 1959, p. 32-36.

4960* Engineer Recruitment. Caution and Prudence on Both Sides. Fewer than one engineer in ten will change jobs next year. Recent reports of widespread pirating, auction-block bidding, and luxurious entertainment are wildly exaggerated according to this survey. ***Dora Merris.*** *Product Engineering*, v. 30, no. 45, Nov. 2, 1959, p. 28 + 2 pages.

4961* Logarithmic Diagrams Solve Your Equations. Charts can be drawn up for almost any frequently solved equation. ***Gil Riske.*** *Product Engineering*, v. 30, no. 48, Nov. 23, 1959, p. 62-65.

4962* Determination of Characteristic Values. Presents a refinement of the cubic polynomial, which is shown to possess properties that make it superior to the previous polynomial, on the basis of theoretical and practical considerations. Theoretically, the modified approach is seen to become identical with the Jacobi method for symmetric matrices, in certain cases; practically, the modification has been found to lead to more rapid convergence, at least for a considerable number of certain matrices that were subjected to both techniques. ***Mark Lotkin.*** *Quarterly of Applied Mathematics*, v. 17, no. 3, Oct. 1959, p. 237-244.

4963* Some Properties of Rational Transfer Functions and Their LaPlace Transformations. Determines other properties of the class k functions and then extends the restrictions on their corresponding transient responses to the transient responses of any transfer function. Develops a means for determining bounds on the transient responses of any transfer function, whether or not that transfer function is a class k function, by relating it to a class k function. ***Armen H. Zemanian.*** *Quarterly of Applied Mathematics*, v. 17, no. 3, Oct. 1959, p. 245-253.

4964 The Free Commutative Entropic Logarithmetic. The commutative and entropic congruence relations determine a homomorphism on the free logarithmetic £, the arithmetic of the indices of powers of the generating element of a free cyclic groupoid. A necessary and sufficient condition that two indices should be concordant is that the bifurcating trees corresponding to these indices should have the same number of free ends at each altitude. It follows that the free commutative entropic logarithmetic can be represented faithfully by index Ψ-polynomials in one indeterminate. ***H. Minc.*** *Royal Society of Edinburgh, Proceedings*, Sec. A, Mathematical and Physical Sciences, v. 65, pt. 2, 1958-59, p. 177-192. (Q41 R80.7p Vis.)

4965 Solution of the Equation $ze^z = a$. The roots of the equation $ze^z = a$ are of importance in several theories. Here we solve the equation, in the sense that we define the sequence $\{ Z_n \}$ of roots and, except for a small, finite number of values of n, find a rapidly convergent series for Z_n. The terms in this series are alternately real and purely imaginary and so the series is very convenient for calculation. ***E. M. Wright.*** *Royal Society of Edinburgh, Proceedings*, Sec. A, Mathematical and Physical Sciences, v. 65, pt. 2, 1958-59, p. 193-203. (Q41 R80.7p Vis.)

4966* Scholarships, Fellowships and Loans. A valuable reference guide to available educational scholarships, etc., in the United States. ***S. Norman Feingold.*** v. I, 1949, 254 pp; v. II, 1951, 312 pp; v. III, 1955, 471 pp. Bellman Publishing Co., Boston. (LB2338 F32s Ref.)

4967* Use of Half-Normal Plots in Interpreting Factorial Two-Level Experiments. ***Cuthbert Daniel.*** *Technometrics*, v. 1, no. 4, Nov. 1959, p. 311-341.

4968* On the Analysis of Factorial Experiments Without Replication. This paper discusses several methods for judging which of m contrasts provided by a factorial design without replication may be different from zero. These include the technique of half-normal plotting, proposed by C. Daniel, for which some operating characteristics are given. ***Allan Birnbaum.*** *Technometrics*, v. 1, no. 4, Nov. 1959, p. 343-357.

4969* Quality Control Methods for Several Related Variables. The methods described in an earlier article devoted to control methods for two related variables are extended to the case of more than two related variables. The concept of matrix notation is introduced because of the resultant simplification in multivariate analysis and the original two-variable problem is restated in matrix form. ***J. Edward Jackson.*** *Technometrics*, v. 1, no. 4, Nov. 1959, p. 359-377.

4970* The Analysis of Latin Squares With a Certain Type of Row-Column Interaction. A serious limitation in the use of latin squares is the confounding of the main effect of each factor with the interaction of the remaining two factors. In some cases, the interaction of rows and columns can be expressed as a multiplicative term of assigned factors associated with rows and columns. The analysis of such designs is presented in detail. ***John Mandel.*** *Technometrics*, v. 1, no. 4, Nov. 1959, p. 379-387.

4971* Evaluation of Chemical Analyses on Two Rocks. Interlaboratory and round robin test programs can provide information, not only on a test procedure under investigation, but on the participating laboratories as well. A simple graphical technique is proposed to aid in the comparisons between laboratories. ***W. J. Youden.*** *Technometrics*, v. 1, no. 4, Nov. 1959, p. 409-417.

4972* How to Disagree Agreeably. Report on observation of a number of meetings, conferences, seminars, and classes where a study was made of how some people disagree in a way that's inoffensive, helpful, and agreeable. ***S. G. Williams.*** *Textile World*, v. 110, no. 1, Jan. 1960, p. 109 + 2 pages.

4973 The Business Man in Politics. Business and political leaders discuss the role of the business man in politics and suggest programs of positive political action for both business enterprises and the individual business man. Other contributors define some of the critical challenges confronting top management today. ***Albert Newgarden, editor.*** 146 pp. 1959. American Management Association, New York. (JF2051 Am35.3b)

4974* Toxicity and Other Hazards of Beryllium and Rocket Propellants. Seventy-three references to unclassified reports on the toxicity, occupational hazards, and safety measures regarding Be and certain rocket propellants, chiefly B

compounds. ***William E. Bost, compiler.*** 9 pp. July 1959. U. S. Atomic Energy Commission, Washington, D. C. (ZQD 181.B4 Un3.1t Ref.)

4975 Variable Metric Method for Minimization. The minimization method described has been coded for the IBM-704 using Fortran. Experience is now being gathered on the operation of the method with diverse types of functions. Parts of the procedure, not incorporating all of the provisions described here, have been in use for some time in least-squares calculations for such computations as the analysis of π-P scattering experiments, *(6)* for the analysis of delayed neutron experiments, *(7)* and similar computations. ***William C. Davidon.*** *U. S. Atomic Energy Commission, ANL-5990* (Rev.), Nov. 1959, 21 pp. (UF767 Un3.1an Contin.)

4976* Applications of a Theorem on Partitioned Matrices. A reduction formula for partitioned matrices is applied to block-stochastic matrices and other types of partitioned matrices in order to reduce the computation in finding the eigen values. ***Emilie V. Haynsworth.*** *U. S. National Bureau of Standards, Journal of Research, Section B, Mathematics and Mathematical Physics,* v. 63B, no. 2, Oct.-Dec. 1959, p. 73-78.

4977* Uniform Asymptotic Expansions for Weber Parabolic Cylinder Functions of Large Orders. *F. W. J. Olver.* *U. S. National Bureau of Standards, Journal of Research, Section B, Mathematics and Mathematical Physics,* v. 63B, no. 2, Oct.-Dec. 1959, p. 131-169.

4978* On the Convergence of the Method of Steepest Descent for Nonlinear Equations. (*In Russian.*) O skhodimosti metoda naiskoreĭshego spuska dlya nelineĭnykh uravneniĭ. ***M. M. Vainberg.*** *Akademiia Nauk SSSR, Doklady,* v. 130, no. 1, Jan.-Feb. 1960, p. 9-12.

4979* Uniqueness Theorem for Holomorphic Functions Bounded Within a Unit Circle. (*In Russian.*) Teorema yedinstvennosti dlya funktsiĭ, golomorfnykh i orgranichennykl v yedinichnom kruge. ***I. B. Ushakova.*** *Akademiia Nauk SSSR, Doklady,* v. 130, no. 1, Jan.-Feb. 1960, p. 29-32.

4980* Morse Inequalities for a Dynamical System. *Stephen Smale.* *American Mathematical Society, Bulletin,* v. 66, no. 1, Jan. 1960, p. 43-49.

4981 Annual Report of the Board of Regents of the Smithsonian Institution. Shows operations, expenditures, and condition of the Institution for the year ending June 30, 1958. 559 pp. 1959. United States Government Printing Office, Washington. (Q11 Sm69 Vis.)

4982 The Childhood Pattern of Genius. The author has based his survey on a sample of 20 men of genius and concludes there is a typical developmental pattern. ***Harold G. McCurdy.*** Paper from "Annual Report of the Smithsonian Institution", p. 527-542, 1959. United States Government Printing Office, Washington. (Q11 Sm69 Vis.)

4983* A Statistical Approach to Stores Auditing. Statistical methods can be used to give results that are sufficiently accurate for most purposes with only a fraction of the amount of exact checking otherwise required. ***John S. James.*** *Applied Statistics,* v. 8, no. 3, Nov. 1959, p. 145-157.

4984* Adjusting Single Sampling Plans for Finite Lot Size. Describes a simple method for finding the sample size and acceptance number appropriate to a lot of finite size, so that the resulting operating characteristic curve closely approximates that for a given plan with an infinite lot. ***Hugo C. Hamaker.*** *Applied Statistics,* v. 8, no. 3, Nov. 1959, p. 210-214.

4985 Causality. The Place of the Causal Principle in Modern Science. This is an essay on determinism, with special emphasis on causal determinism—or causality, for short. The author sides with the minority that regards causal determinism as a special form of determinism, namely, that kind of theory that holds the unrestricted validity of the causal principle to the exclusion of every other principle of determination. The rational ground for regarding causality as a form of determinism, and not conversely, is that modern science employs many noncausal categories of determination or lawful production, such as statistical, structural, and dialectical, though they are often couched in causal language. ***Mario Bunge.*** 380 pp. 1959. Harvard University Press, Cambridge, Massachusetts. (Q175 B88c)

4986* "Stolen From Gichner." A contractor discusses the constant problem of employee theft and steps that can be taken to control it. ***Lawrence Gichner.*** *Heating & Air Conditioning Contractor,* v. 51, no. 5, Feb. 1960, p. 45-48.

4987 The Job of the Federal Executive. A report on the executive's job in government as based on a series of round table conferences at the Brookings Institution. ***Marver H. Bernstein.*** 241 pp. 1958. The Brookings Institution, Washington, D. C. (JK723.E9 B45j)

4988* The Architect and Architectural Engineer in the Nuclear Age. Discusses necessity of training architects and architectural engineers in nuclear defense building design. ***Gifford H. Albright.*** *Journal of Engineering Education,* v. 50, no. 5, Feb. 1960, p. 375-379.

4989 Lectures in Applied Mathematics. v. I. Probability and Related Topics in Physical Sciences. Nature of probabalistic reasoning; techniques of probability theory; probability in some problems of classical statistical mechanics; integration in function spaces; applications. ***Mark Kac.*** 266 pp. 1959. Interscience Publishers, New York. (QA273 K11p)

4990* McKay's Guide to Alaska. This is the latest addition to the popular series of McKay's Guides. The author has lived in Alaska and knows the state firsthand. Everything a prospective visitor or settler needs to know is covered. ***Robert G. Hart.*** 330 pp. 1959. David McKay Co., Inc., New York. (F904 H25m Ref.)

4991* What Would a Fire Do to Your Plant? Concerns mainly fire prevention measures in the printing industry. ***Jack Stroube.*** *Modern Lithography,* v. 28, Feb. 1960, p. 34 + 3 pages.

4992 Modern Science and the Human Fertility Problem. From the premise that population growth is the greatest single deterrent, with the exception of war, to economic development in the poorer territories of the world, the book examines the new scientific possibilities in the control of human fertility. It explores their potential impact on population growth as well as on the social institutions and the economies of various societies. ***Richard L. Meier.*** 263 pp. 1959. John Wiley & Sons, New York. (HQ766 M47m)

4993* Where Unions Get Power. Recent reform measures do not affect these five sources of labor strength. *Nation's Business,* v. 48, Mar. 1960, p. 36 + 2 pages.

4994* 8 Tests Spot Initiative. Men who can do their jobs well leave time for you to do yours. ***Howard R. Dressner.*** *Nation's Business,* v. 48, Mar. 1960, p. 104-106.

4995 Measurement of Status Relations in a Hospital. Deals with the analysis of a status description scale; a tool which is designed to measure stratification within a hospital social system. Research in the field of social stratification has largely been done at the community level with little research effort devoted to measuring stratification within an organization. The development of the status description scale was a necessary part of a larger investigation of social stratification and medical performance. ***L. Edna Rogers.*** *Ohio State University, Engineering Experiment Station Bulletin* 175, May 1959, 55 pp. (TA21 O3b Vis.)

4996 The Social Responsibilities of Scientists. A scientist can no longer shirk responsibility for the use society makes of his discoveries. ***Bertrand Russell.*** *Science,* v. 131, Feb. 12, 1960, p. 391-392.

4997 The Story of Tata Steel. Story of the largest single private enterprise in India and its principal steel producer. ***Verrier Elwin.*** 118 pp. 1958. Tata Iron and Steel Company, Bombay, India. (HD9526.I4 EL87s)